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A SURVEY ON RADIOGRAPHERS CONCEPT KNOWLEDGE AND PERFORMANCE TOWARDS GONADAL SHIELDING PROTECTION IN DELHI NCR, INDIA

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ABBREVIATIONS

S.NO	Abbreviations	Definitions
1.	ALARA	As Low as reasonably achievable
2.	ICRP	International commission on radiological protection
3.	AAPM	American association of Physicists in Medicine
4.	RP	Radiation Protection
5.	AERB	Atomic energy regulatory board
6.	AP	Anterior posterior
7	NRPB	National radiological protection board
8	GCS	Glass gow coma scale
9	DIP	Diagnostic imaging procedure
10	GS	Gonadal shielding
11	HOD	Head of Department

ABSTRACT

Background: Gonad shielding has significant role in practice of radiology. In order to minimize radiation exposure to the reproductive organs and lower the danger of genetic damage and other negative effects, gonadal shielding is an essential radiography technique. Despite its significance, gonadal shielding has not always been applied correctly, putting patients' health at risk. As the main users of radiological equipment, radiographers are essential in making sure that this safety precaution is followed correctly. Nevertheless, there is little information available about the comprehension and actual performance of radiologists in following gonadal shielding measures in areas such as Delhi NCR, India. It is crucial to comprehend the present level of radiographers' competence and understanding in order to enhance training initiatives and guarantee patient safety.

Aim & Objective: This study aim is to examine radiographer's concept knowledge and Performance towards gonadal shielding protection in Delhi NCR, India, estimate and understand the significance and importance of shielding for radio technologists, explore the correlation between radiographer's concept knowledge and their actual performance in utilising gonadal shielding, ensure personal safety during radiological procedures, maping, recommendation to improve radiation safety.

Material & Method: The cross-sectional study, data collection was conducted via google form (structured questionnaire), with the consent of respective radiographers around different diversity from various health care industries in several hospitals, medical facilities, and conservatoires in the Delhi NCR. The data of 382 radiographers employed in the radiology department made up the study population. It is a survey-based study, a google form questionnaire was created for radiographers to evaluate their performance in applying GS (Gonad Shielding) in pelvic regions was assessed. Ethical clearance was taken from institution before data got collected.

Results: The results of the survey showed that although most radiographers in Delhi NCR are familiar with the fundamentals of gonadal shielding, there are notable gaps in their advanced comprehension and the appropriate use of this countermeasure. A little over 75% of respondents showed a thorough comprehension of gonadal shielding measures, however only 60-65% of them regularly used these techniques when doing radiography operations. Furthermore, the research revealed a number of variables that had a substantial impact on knowledge and performance, such as years of experience and educational attainment.

Conclusion: The study emphasizes how vital it is to provide radiographers in Delhi NCR with improved training and awareness programs in order to increase their understanding and ability to use gonadal shielding protection in practice. The need for revised guidelines and more stringent adherence to radiation safety protocols is highlighted by the notable disparities between theoretical comprehension and practical application.

Keywords: Gonadal shielding, Medical Imaging, Radiation safety protocols, Patient safety, Reproductive organs.

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CHAPTER – 1

INTRODUCTION

In radiology, the gonadal shield is a barrier that is used to protect the gonads (ovaries or testicles) from radiation exposure when doing imaging tests like fluoroscopy, CT scans, or X-rays. This lead shielding is frequently applied over the gonads to reduce radiation exposure to these delicate structures.[34]. Patient shielding is established procedure in diagnostic imaging.[35]

This is crucial because radiation exposure might potentially result in genetic abnormalities or have an adverse effect on reproductive health because the gonads are extremely susceptible to radiation.

The biological effects of ionizing radiations are a worry, since research suggests that medical uses of radiations have detrimental consequences (Hendee, Edwards, 1996).[29].Since the 1950s, gonad shielding has been advocated for pelvic x-rays.[27] Radiographers' understanding of protection and safety principles and their correct implementation plays an important role in radiation protection[31]

Gonad shielding is one of the primary ways for protecting reproductive organs.[24] The science and art of protecting people and the environment is known as radiation protection. [23].The use of gonad shielding during diagnostic X-ray procedures is an efficient means of lowering the possibility of genetic damage in future generations.[28]

Lead or lead-equivalent materials, which efficiently block or greatly reduce the quantity of radiation that reaches the sensitive reproductive organs, are typically used to make gonadal shields. Children should wear these shields especially. since they are more vulnerable to thelong-term effects of radiation.

But because of recent technological developments, there has been a growing debate regarding the value and necessity of routine gonadal shielding in contemporary radiology. Therefore More attention should be used to properly position the gonad shields.[32].Full coverage to the gonads has to be there[33].

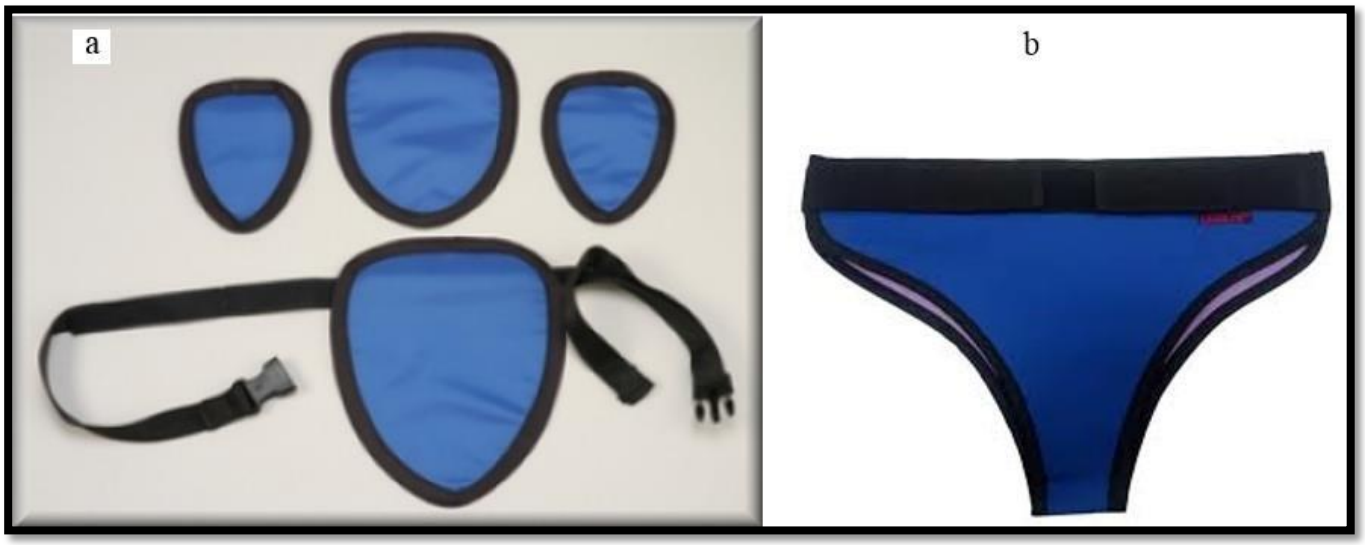

Fig-1a. Variant gonad shields; b- Gonad shield

Ionizing radiation-based medical imaging is essential for the diagnosis and management of disease. Around the world, more than 10 million diagnostic radiological operations have been carried out. The detrimental consequences of ionizing radiation continue to be an unavoidable issue, despite the benefits of diagnostic radiology having been demonstrated. Of all the imaging techniques, conventional radiography—also referred to as low dose radiation—is the most often used imaging process. There are no safe ionizing radiation doses, according to the linear no-threshold theory, albeit the consequences of low doses might not be felt right away after exposure and might show up in the exposed population in the future. Thus, radiation protection (RP) methods and patient dose optimization should be taken into consideration based on the ALARA concept.

In order to minimize patient dose and maintain image quality, optimization involves striking a compromise between radiation doses and image quality. In the RP field, there are a variety of techniques to lower the patient dose, including patient immobilization and positioning, suitable collimation and filtration, protective shields, small focal patches, grids, and shorter exposure times. It is strongly advised to reduce the dose while doing the radiological treatment with the simulated gonadal shield perfectly aligned with the gonads.[22] Its utilization is dependent on the attitudes of medical imaging technologists (MITs) to constantly adhere to professional behavior guidelines for the use of gonad shielding.[26]

Among the most crucial organs to be protected in order to minimize the dosage that is received are the gonads. The key factor, according to radiobiology principles, is the gonad cells' quick division. Gonadal cells are more vulnerable to radiation damage than other types of cells because of this characteristic. One of the risks of radiation exposure to reproductive cells is genetic damage, because germ cells may get mutated as a result of ionizing radiation and be passed down to subsequent generations. Therefore, in order to minimize the radiation exposure of gonads to the lowest reasonably feasible level, it is imperative to take into account the RP principles and guidelines. Lead-lined aprons and gonad shields are the two most common types of shields. Lead-lined aprons are large shields used to protect organs outside of the imaging field, whereas gonad shields are small shields used to protect gonads within the imaging area.

Radiation exposure causes gonads to have too many negative side effects, and even low radiation levels can have an impact on them. Pelvic radiography is one of the most often performed X-ray examinations. Gonads are prone to high doses during radiography exams in the vicinity of the pelvis.The likelihood of genetic harm is roughly 10 per million people per million mSv, according to ICRP. Since 1950, gonadal shielding, or GS, has been considered a workable way to lessen gonad exposure to radiation. GS decreases administered dosages to the ovaries by approximately 50% and the testes by approximately 95%. Consequently, GS might be very useful and crucial in reducing the impacts of genetics. Guidelines and conventions govern the use of GS: When a patient is at or below reproductive age, GS should be taken into consideration. It should also be inserted when the gonads are positioned inside or close to a radiation field. Finally, GS should not be used as a justification for improper patient positioning or inadequate beam collimation.[1] Gonadal shielding is still widespread, however current estimates of gonadal radiation risk are lower than the hazards to the colon and stomach.

Fig - 2a. Where to were; Fig b- Gonad shield on pubic symphysis

Among the most important organs that require protection to reduce the quantity of radiation they take in are gonads. Radiographers play a critical role in ensuring patient safety throughout radiography treatments. Ensuring that gonadal shielding is used appropriately is a crucial aspect of their work, but there are problems with radiographers' conceptual understanding and practical application of this preventive measure.[2]

Radiation protection

Radiation protection is the science and art of protecting people and the environment from the harmful effects of ionizing radiation.[6] Gonad shielding is necessary in the precaution of infertility.[18] Conventional X-ray radiation is linked to the exposure of radiosensitive organs and usually necessitates the use of protective gear.[7] 1.1 Radiation Exposure In order to aid lower radiation exposure to sensitive body parts, particularly the gonads, radiology departments have historically routinely placed a lead-lined material device, such as GCS, directly on the patient's surface during diagnostic imaging procedures (DIP). It was believed that by protecting the reproductive organs from radiation, this procedure would reduce the likelihood of adverse effects occurring. Furthermore, "anecdotal evidence suggests that shielding patients makes them feel more secure and less anxious, and it is a demonstration that the radiology professional is concerned for their safety."[10,13]

Radiation protection principles

Medical imaging based on ionizing radiation plays a major role in illness detection and therapy. Globally, more than 10 million diagnostic radiological procedures have been performed. It is still impossible to completely eliminate the risk of ionizing radiation, despite the known benefits of diagnostic radiography. Among the several imaging modalities, conventional radiography—also known as low dosage radiation—is the most often utilized imaging technique. The linear no-threshold theory contends that there are no safe levels of the metal, even though the effects of low doses of ionizing radiation may not be felt right away and may show up in the generation that follows exposure. As a result, techniques for patient dose optimization and radiation protection (RP) must be considered in light of the ALARA principle. [1] Among the most important organs that require protection to reduce the quantity of radiation they take in are gonads. Radiographers play a critical role in ensuring patient safety throughout radiography treatments. Ensuring that gonadal shielding is used appropriately is a crucial aspect of their work, but there are problems with radiographers' conceptual understanding and practical application[21] of this preventive measure.[2] Quality controlling these tests guarantees that each patient receives efficient, high-quality care while promoting uniformity in the medical imaging division.[11] Radiographers should need to work in the area of 'improvement capability' for radiation protection [12]

Safety guidelines

The need for education and training in radiation safety for the concerned medical specialists was recognized long ago, and various international organizations have published recommendations in this regard.[30]

NRPB (National Radiation Protection Board) Guidelines NRPB guidance about gonad Protection should be implemented in all radiological procedures.[8] Optimization seeks to balance radiation doses and picture quality in a way that minimizes patient exposure while maintaining image quality. There are several ways to reduce the patient dose in the RP field, such as situating and immobilizing the patient, using appropriate collimation and filtering, shielding the patient, using grids, small focused patches, and reducing exposure durations.[3] The International Commission on Radiological Protection (ICRP) [20] traditionally regarded the gonads as a radiosensitive organ with the highest tissue weighting factor of any organ.[16] Protecting gonads is essential to reducing the amount of radiation they absorb, as they are one of the most important organs. Based on

principles of radiobiology, the gonad cells' rapid division is the crucial element. Gonadal cells have a feature that makes them more susceptible to radiation damage than other cell types. One of the concerns of radiation exposure to reproductive cells is genetic impacts; radiation can alter germ cells, resulting in mutations that are carried down to future generations. Thus, it is essential to consider the RP standards and principles in order to reduce the radiation exposure of the gonads to the lowest level that is reasonable. There are an infinite number of possible perspectives, it is said, and each will define the elements differently and emphasize the connections between them in a different way. Although this may provide an explanation for the limited use of evidence-based radiography, it is important to keep tracking the beliefs and perspectives of radiographers in clinical settings in order to identify areas that require further research and critical thinking. [4] It is acknowledged by the American Association of Physicists in Medicine (AAPM) that medical imaging operations ought to be appropriate and carried out with the least amount of radiation. In order to prevent recommended procedures with clinical advantages from being refused, the AAPM emphasizes that discussions regarding the dangers associated with radiation exposure from medical imaging procedures should also take into account the benefits of the procedure.[9]

ICRP (International Commission on Radiological Protection) guidelines

The ICRP is an independent, multinational organization dedicated to protecting humans and animals from radiation.

• The International Commission on Radiation Protection advises laws, legislation, and practices to reduce dangerous radiation.

• The ICRP standards for radiological protection adhere to three basic principles: rationale, optimization, and dose limitation.. In 1958, the ICRP suggested a genetic dose limit of 5 rem (50 mSv) per generation[5, 17]Gonad shielding is an important way to address the ‘as low as reasonably achievable’ (ALARA) requirement in radiography[13] Many methods of gonad shielding were proposed, such as projection shields, flat contact shields, and testicular capsules. The projection shield involved placing the shield on a PMMA rotatable disk to be placed on the diaphragm housing, or on a platform. Further early designs and references can be found in Büchner, Stieve, Markó, and Grigg. It has also been proposed to introduce $BaSO_4$ into the digestive system as an internal insulator for the ovaries and fetus. A few ancient gonad shields together with the year the literature first described them. On the images from 1923, 1952, and 1958 a, testes capsules can be seen at the bottom right of the picture. The 1957 drawing shows a PMMA T-shaped board with 2-mm lead (shaded) for testes shielding. Females wearing flexible

contact type shields can be seen in pictures from 1958a and 1963. The devices in the photographs from 1958b and 1961 are of the projection kind, with the first positioned someplace above the patient and the latter fixed to the X-ray diaphragm. According to the ALARA principle, the patient's radiation exposure must be maintained as low as reasonably possible.[15] The dosage to the ovaries and testes can be decreased by roughly 50% and 95%, respectively, with proper gonad shielding.[14]

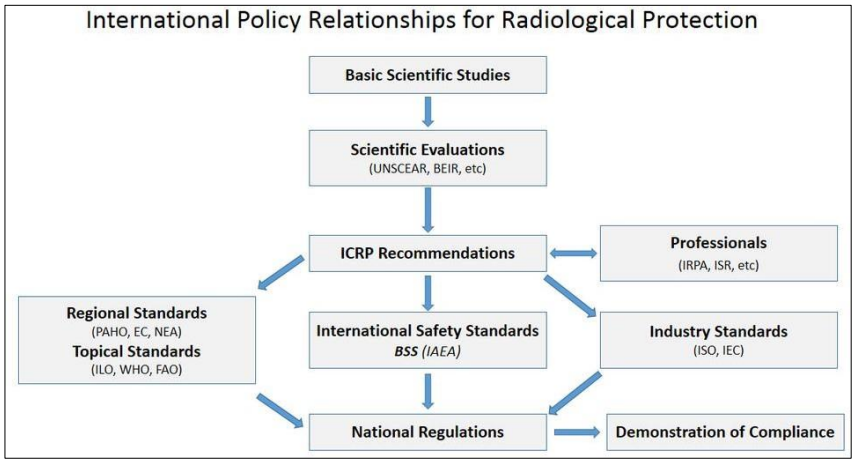

Fig - 3. International commission on radiological protection policy.

1. 5 AERB (Atomic Energy Regulatory Board) guidelines

Fig - 4. Logo of AERB

- **Justification**

No practice, or source within a practice, should be permitted unless it generates enough benefits for society or the exposed individuals to outweigh any potential radiation risks; in other words, unless the practice is warranted, considering social, economic, and other pertinent considerations.

- **Optimisation**

(ALARA) Background radiation, which comes from both natural and artificial sources, exposes all living organisms to ionizing radiation. Because ionizing radiation exposure can lead to biological changes in the individual exposed, occupational workers' doses should be kept as low as reasonably achievable (ALARA), and patient doses should be optimized. Appropriate control strategies must be used to reduce radiation exposure in order to maximize benefits while minimizing radiological danger.

- **Dose Limitations (Never exceed Dose Limits)**

To guarantee that no one is exposed to a danger that is deemed intolerable, dose limitations should be applied to the typical exposure of individuals resulting from all pertinent procedures.

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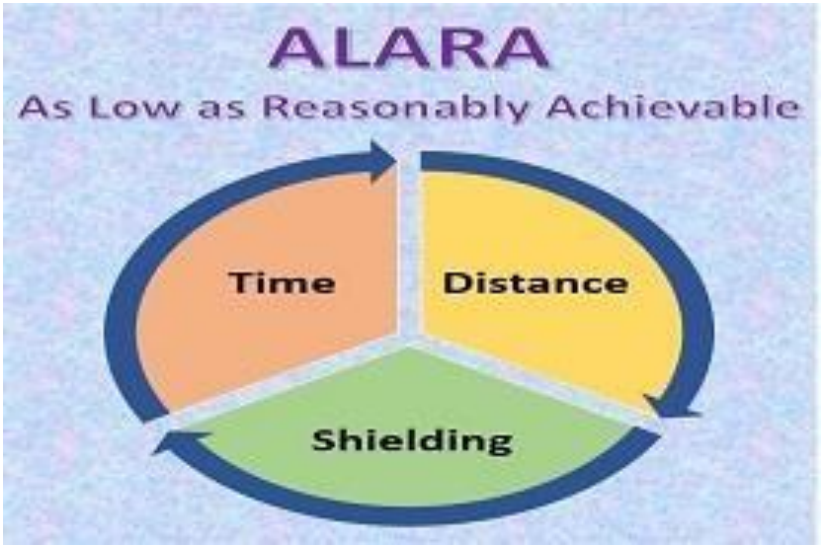


Fig - 5. AERB guidelines.

CHAPTER – 2

NEED FOR STUDY

Need for Study

Radiation shielding is an essential part of radiography practice, particularly when dealing with delicate body parts like the gonads, which are particularly vulnerable to genetic harm caused by radiation. In order to reduce radiation exposure to reproductive organs during diagnostic imaging, gonadal shielding is highly advised. Nevertheless, in many healthcare settings, adherence to gonadal shielding regimens is still uneven, despite its well-established advantages. Comprehensive data on radiographers' understanding and adherence to gonadal shielding techniques is lacking in the Delhi NCR region, where the use of diagnostic radiography is growing due to expanding healthcare demands. The topic has been the subject of numerous studies conducted all over the world, but little of it has been done with an Indian perspective, especially in cities like Delhi NCR. Concerns regarding patient safety are raised by this knowledge vacuum. And the effectiveness of current radiation protection training programs for radiographers.

Following are the basic reasons and necessities of this study:

- Analyze the present gonadal shielding procedures and expertise of radiographers.
- Determine any gaps in their performance and training.
- Make recommendations based on data to increase radiation safety in the healthcare sector in Delhi NCR.

CHAPTER – 3

AIM AND OBJECTIVES

AIM

This study aim is to examine radiographer's concept knowledge and Performance towards gonadal shielding protection in Delhi NCR.

OBJECTIVE

Objective 1 - To estimate and understand the significance and importance of shielding for radio technologists.

Objective 2 - To explore the correlation between radiographer's concept knowledge and their actual performance in utilising gonadal shielding.

Objective 3 - To ensure personal safety during radiological procedures, mapping, recommendation to improve radiation safety.

CHAPTER – 4

REVIEW OF LITERATURE

Hamzian N, Asadian S, Golestani A, Zarghani H. 2021 The research focuses specifically on hospitals in the Southern Khorasan Province of Iran. The paper presents a comprehensive evaluation, utilizing a structured questionnaire to gather data from radiographers working in diagnostic radiology departments. This methodology allows for a systematic exploration of radiographers' understanding, perspectives, and actual practices regarding gonadal shielding. One notable strength of the study lies in its attention to both knowledge and attitudes, in addition to performance. This holistic approach provides a nuanced understanding of the factors influencing radiographers' adherence to gonadal shielding protocols.By examining not just what radiographers know and do but also how they feel about these practices, the study offers valuable insights for designing targeted interventions to improve compliance. The findings of the study shed light on areas where further training or education may be necessary. For instance, if radiographers exhibit knowledge gaps or negative attitudes towards gonadal shielding, interventions can be tailored to address these specific issues.

Doolan A, Brennan PC, Rainford LA, Healy J.. 2004" addresses an important aspect of radiation safety in medical imaging. The authors likely discuss the risks associated with radiationexposure to the gonads during pelvis imaging. The gonads are particularly sensitive to radiation, and protecting them is essential, especially in diagnostic radiography where repeated exposures may occur. The review may include a summary of historical efforts and recommendations for gonad protection in radiography. This could involve previous studies, guidelines, and practices aimed at minimizing radiation exposure to reproductive organs. The authors would likely discussthe prevailing practices regarding gonad protection during antero-posterior (AP) pelvis imaging in Dublin hospitals at the time of the study. This may involve a survey of radiographers and their adherence to established protocols for gonad shielding. Effectiveness of Gonad Shielding: The literature review may delve into studies assessing the effectiveness of various gonad shielding techniques and devices. This could include discussions on the efficacy of lead aprons, shadow shields, and other protective measures in reducing

radiation dose to the gonads. Barriers to Implementation: The article might explore any barriers or challenges faced in implementing gonad protection measures consistently in clinical practice. This could include factors such asradiographer training, availability of shielding devices, workflow constraints, and patient compliance.

Hayre CM, Blackman S, Carlton K, Eyden A. 2018. Through qualitative research methods, the study delves into the cultural and contextual factors influencing radiographers' practices and decision-making regarding lead protection. The findings shed light on the complexities surrounding the use of lead aprons, highlighting variations in perceptions, adherence to guidelines, and organizational influences. This ethnographic study contributes valuable insights into the human factors affecting radiation protection practices in radiography,offering implications for improving safety protocols and professional training within the field.

Jeukens CRLPN, Kütterer G, Kicken PJ, Frantzen MJ, van Engelshoven JMA, Wildberger JE, Kemerink GJ. 2020 by suggesting that modern optimized X-ray systems may render it unnecessary. Through a thorough review, the authors argue that advancements in technology and imaging techniques may provide sufficient protection to the gonads without the need for additional shielding. This perspective challenges longstanding practices in radiography, opening up discussions regarding the optimization of radiation safety protocols. However, further research and consensus within the radiology community are warranted before definitive changes in practice can be recommended.

Warlow et al.'s 2014, the study explores the effectiveness of shielding techniques in minimizing radiation exposure to the gonads during medical imaging procedures. The research critically examines current practices and evaluates their impact on reducing radiation risks, particularly in the vulnerable pediatric population. Through meticulous analysis and empirical evidence, the authors contribute valuable insights to the ongoing discourse surrounding radiation safety protocols in pediatric radiography.

SeifeTeferi, YoditTequabo, and Daniel Bedane in 2017 " explores the implementation of gonad shielding in pelvic radiography. The authors delve into the significance of gonad shielding

in minimizing radiation exposure to reproductive organs during medical imaging procedures. Through their preliminary study, the authors assess the current practices of gonad shielding among radiographers. They likely discuss the prevalence of adherence to guidelines, potential barriers to implementation, and the overall effectiveness of gonad shielding techniques.

"Knowledge and Performance of Radiographers towards Radiation Protection in Taif, Saudi Arabia" done in 2015 by Rania Mohammed Ahmed et al. published in the IOSR Journal of Dental and Medical Sciences focuses on assessing the level of knowledge and performance ofradiographers regarding radiation protection measures. The study, conducted in Taif, Saudi Arabia, sheds light on the crucial aspect of ensuring the safety of both patients and healthcare workers in radiology settings. The research methodology likely involves surveys or assessments to gauge radiographers' understanding of radiation safety protocols and their implementation in practice. The findings could potentially highlight areas of improvement in training programs or workplace protocols to enhance radiation protection practices. The article likely contributes valuable insights into the knowledge gaps and performance challenges among radiographers regarding radiation protection, with implications for enhancing safety measures in radiology departments.

Vom and Williams delves 2017, it highlights key issues pertinent to the justification process. By examining factors such as patient risk, diagnostic yield, and alternative imaging modalities, the authors provide valuable insights into the decision-making process for conducting radiographic exams. Their exploration contributes to the ongoing discourse on optimizing healthcare practices and ensuring patient safety in radiology.

Cardoso, Bezzina, and Portelli 2022 investigates current practices and attitudes towards gonad shielding among radiographers. The survey provides insights into the prevalence of gonad shielding techniques, adherence to guidelines, and factors influencing the use of shielding devices. By examining the perspectives of radiographers, the research sheds light on the challenges and opportunities in promoting radiation safety in medical imaging, the article contributes valuable information to the field of radiography, highlighting the importance of optimizing radiation protection practices for patients undergoing imaging procedures.

Caruana, Hayre, and Makanjee's 2023 explores radiographers' perceptions regarding the quality of managing general radiographic pediatric examinations utilizing a reflective tool. Published in PLoS One, the study delves into an important aspect of pediatric radiography, shedding light on how reflective practices can impact quality management in this field. By investigating radiographers' perspectives, the authors provide valuable insights into the efficacy of reflective tools in enhancing the quality of pediatric radiographic examinations. This study contributes to the ongoing discourse on improving healthcare practices through reflective methodologies, particularly in pediatric radiography.

Furnival, Boaden, and Walshe's , 2017, offers a comprehensive examination of improvement capability within healthcare contexts. The authors delve into conceptual frameworks and assessment methods, providing valuable insights for evaluating and enhancing organizational capacities for improvement. Their review contributes to the understanding of key factors influencing successful quality improvement initiatives, offering practical implications for healthcare practitioners and policymakers.

C. Buissinka,et al 2020 investigates the impact of gonad shielding for AP pelvis exams onboth dose and image quality across different female sizes, using a phantom study. The study, published in Radiography, offers valuable insights into optimizing radiation protection practices while maintaining image quality. By focusing on various female sizes, the research addresses a significant gap in understanding how shielding affects different body types. The findings contribute to enhancing patient safety and imaging protocols in radiography, with potential implications for clinical practice. Overall, the article provides valuable information for radiographers and healthcare professionals involved in pelvic imaging.

Kumar A, Chau WW, and Hung AL, et al 2018 This article reviews the use of gonadal shielding in imaging for developmental dysplasia of the hip (DDH) in children and challenges the necessity of its routine application. The authors argue that, while gonadal shields have traditionally been used to protect reproductive organs from radiation, advancements in imaging

technology have significantly reduced radiation exposure. In the context of DDH, these shields often obstruct crucial anatomical structures, leading to misdiagnosis or the need for repeat imaging, which can paradoxically increase cumulative radiation doses. Studies cited include Matsubara et al. (2014) and Frush & Donnelly (2017), which highlight the potential diagnostic hindrance caused by shields in modern low-dose radiology. The article calls for updated guidelines and a more selective use of shielding, especially in pediatric orthopedic research, where accurate imaging is critical for diagnosis and treatment planning. It emphasizes that gonadal shielding may be an outdated practice in certain clinical and research contexts, particularly when it compromises diagnostic accuracy.

Kaplan et al. (2018) explores the impact of female gonadal shielding on radiation exposure, in especially when pediatric radiology uses automated exposure control, or AEC. Gonadal shielding has been used historically to lower radiation hazards to reproductive organs, particularly in females. But since AEC is used in many modern imaging systems, the shield may unintentionally increase radiation exposure. The study offers a critical assessment of how well AEC operates when shielding is used. The radiation dosage is modified by AEC systems according to the patient's body mass and density. The AEC may misread density when shields cover sensitive areas, increasing radiation output to make up for the blocked area and increasing overall exposure. The authors challenge the conventional wisdom that shielding is always advantageous by claiming that shielding can actually raise radiation dangers. This discovery questions established methods in pediatric radiology and indicates that, particularly when using contemporary imaging modalities, revaluating shielding requirements may be required to guarantee patient safety. Kaplan et al. conclude by highlighting the possible risks associated with gonadal shielding with AEC and stressing the need for medical practitioners to revaluate standard shielding procedures in order to reduce the chance of unintentional radiation exposure.

The 1996 report by the International Commission on Radiological Protection (ICRP), published in Annals of the ICRP (Vol. 26, Issue 2) It places emphasis on the optimization of protection, which entails limiting radiation doses to the lowest reasonably possible level (ALARA), and the justification of medical exposure, ensuring that the benefits outweigh the dangers. Although medical exposure is not subject to rigid dose restrictions like other fields, it

nevertheless requires careful management, as the paper defines the concepts of dose limiting.

The study emphasizes the necessity for specific training and instruction in radiation protection as it addresses the roles that practitioners and institutions play in protecting patients and personnel. It also addresses quality assurance initiatives, dosage monitoring, and the use of advanced technologies to reduce unnecessary exposure.

The International Commission on Radiological Protection (ICRP) report, "Radiological Protection and Safety in Medicine" (Ann ICRP, 1996;26(2):1-47), offers thorough instructions for medical practice radiation safety. The purpose of this paper is to reduce the dangers related to ionizing radiation therapy and diagnostic applications. It addresses the ideas of dose limitation, optimization, and justification as cornerstones of guaranteeing the safety of patients and personnel. Radiation therapy must always be utilized more beneficially than harmfully, ensuring that it is only employed when absolutely required and as recommended. For patients and medical staff alike, radiation exposure should be maintained "As Low As Reasonably Achievable" by the use of shielding, better procedural techniques, and the lowest possible effective dose. Strict regulatory limitations should be followed when it comes to staff and bystander exposures, even while patient exposure is controlled by medical need. Procedures requiring large dosages, such as interventional radiology, receive particular consideration. The report also emphasizes the significance of radiological safety education and training, pushing healthcare facilities to put in place extensive safety protocols and radiation exposure tracking systems. A 1997 erratum addressed a few minor points but left the suggestions' main ideas unchanged. This paper continues to be a fundamental source of information in the field of radiation protection in medicine.

4.17. The ICRP report, "Radiation Protection: Protection from Potential Exposures: Application to Selected Radiation Sources" (Ann ICRP, 1997;27(2):1-61), provides thorough instructions on how to manage radiation risks from different sources, with a focus on exposures that may occur unexpectedly or potentially. The fundamentals of radiation safety are expanded upon in this paper to handle uncommon but serious radiation risks. The paper identifies radiation sources that may cause unintentional or intentional exposure, including nuclear power plants,

industrial settings, and medical settings. These exposures are not usual; instead, they may be the consequence of mishaps, defective machinery, or human error. It emphasizes how crucial thorough risk assessments are to identifying and controlling situations where possible exposure may occur. Plans for emergency preparedness and safety should incorporate these assessments. The task group offers detailed suggestions on containment, shielding, and safety devices for particular radiation sources in order to minimize or avoid unintentional exposure. This includes radiation sources used in research, nuclear power generation, and radiological procedures in medicine. The paper is extensive, addressing radiation protective techniques in nuclear medicine, industrial radiography, and other high-risk fields while customizing general guidelines for particular situations. This ICRP research is noteworthy because it applies radiation protection principles to high-risk sources and unusual circumstances, providing useful advice for reducing the possibility of radiation exposure in a variety of industries.

4.18 Somasundaram et al. (2020, looks at the possibility of reducing the dosage when performing X-ray exams while wearing gonadal shielding. The authors simulate radiation exposure during abdominal and pelvic radiography in both children and adults using Monte Carlo models. According to the study, gonadal shielding can significantly lower the radiation doses that are administered to the gonads during radiography operations. However, the patient's size, age, and location can all affect how effective this shielding is. According to the study, juvenile patients see a more noticeable dose decrease than adult patients. This is likely due to their smaller bodies, which allow for more effective shielding, and their higher sensitivity to radiation exposure. The simulations concentrated on X-rays of the abdomen and pelvis, which are frequently used diagnostic techniques for which gonadal shielding has long been advised to reduce radiation exposure to reproductive organs. Despite the benefits, the study also points out some limitations of gonadal shielding, including the potential for misplacement and interference with image quality, which could affect diagnostic accuracy.

The author’s stress that shielding measures must be applied carefully. The study's conclusion emphasizes the necessity for a balanced strategy that takes radiation protection and diagnostic integrity into account, while also suggesting that gonadal shielding can still result in dose reductions, especially in pediatric radiography. The use of Monte Carlo simulations contributes solid data to the current discussion concerning the applicability of gonadal shielding in

contemporary radiology.

Ahmed RM, Elamin AMT, Elsamani M, and Hassan WB (2015), investigates the knowledge and use of radiation safety guidelines by radiographers in Taif, Saudi Arabia. The primary goal of the study is to assess how well radiation safety procedures are understood and applied in clinical settings. The survey finds that although the majority of radiographers comprehend radiation protection ideas on a fundamental level, there are gaps in their grasp of the most recent recommendations and procedures. This implies that continuing education and training are necessary. It was discovered that radiographers' performance in implementing radiation safety practices, including appropriate shielding, dose monitoring, and patient safety precautions, varied. While some radiologists applied safety regulations consistently, others did not. The study finds a number of variables that affect performance, such as years of expertise, theaccessibility of safety gear, and institutional support for continuous training. Lack of proper resources and insufficient updates on radiation protection protocols were noted as barriers to optimal practice. The authors recommend regular training programs and workshops to improve radiographers' knowledge and performance in radiation protection. They also stress the significance of institutional rules that mandate close compliance with safety precautions. The study concludes that radiographers in Taif, Saudi Arabia, require more consistent use of radiation safety protocols and improved instruction. To guarantee that radiographers can successfully shield themselves and their patients from needless radiation exposure, it requires for more institutional assistance.

Karami V, Zabihzadeh M, and Gholami M (2016), assesses and raises concerns about the efficacy and possible downsides of gonadal shielding during traditional radiography exams. The purpose of the study is to determine whether gonadal shielding offers meaningful protection in modern radiography. The authors contend that whereas routine shielding has historically been employed to prevent radiation exposure to reproductive organs, advances in imaging technology have resulted in a significant reduction in radiation doses, calling into doubt the need for routine shielding. The study draws attention to issues with incorrect shield positioning, which might affect image quality and perhaps result in more radiation exposures over time. Shield

misplacement is a frequent issue, especially in pediatric radiography. The authors speculate that gonadal shielding could not be as beneficial as earlier methods since more recent medical technology uses dose reduction strategies and delivers lower dosages.

They contend that significant consideration must be given to striking a balance between patient safety and diagnostic precision. The authors urge a review of standard gonadal shielding, particularly in view of recent developments in imaging. They support further research to ascertain if shielding is still required in all situations and call for radiographers to receive greater training on when and how to use it successfully. The study's conclusion casts doubt on the gonadal shielding's future applicability in contemporary radiology, arguing that—especially in light of recent developments in radiation dose reduction—the hazards of image interference and inappropriate use may exceed the advantages.

Fatahi-Asl J, Tahmasebi M, and Karami V (2013), examines the knowledge and observance of radiation protection procedures by radiographers in various hospitals located in Ahvaz County, Iran. The goal of the study is to determine how well-informed radiographers are about radiation safety and how well they carry these practices out on a regular basis. According to the study, radiographers often understand the fundamentals of radiation protection, such as how to reduce radiation exposure and when to wear protective gear. But there are still gaps in our knowledge, especially when it comes to appreciating the significance of more recent safety regulations and procedures. Radiographers were discovered to use radiation protection inconsistently in practice, despite their knowledge of the precautions. While some radiologists showed how to properly use safety gear, such as lead aprons and shields, others did not consistently adhere to recommended standards. This disparity was caused by a number of factors, including irregular training and institutional oversight. The study identifies important variables that impact radiologists' performance, including institutional support, radiation protection equipment availability, and access to up-to-date teaching materials. In order to enhance radiographers' comprehension and implementation of radiation safety procedures, the authors stress the necessity of ongoing education and professional development initiatives. Hospitals should also make sure that radiographers have access to the appropriate safety equipment and that following safety procedures is routinely checked. Although Ahvaz County radiographers possess a basic awareness of radiation protection, the study suggests that continued training and institutional support are necessary to guarantee the constant

implementation of radiation safety measures in clinical practice.

Karami V, Zabihzadeh M, Shams N, and Sarikhani S (2016), examines the application and efficacy of gonadal shielding for pelvic X-ray examinations in paediatric patients. The study assesses the effectiveness of shielding and how frequently it is employed to lower radiation exposure. The study discovered that during paediatric pelvic X-rays, gonadal shielding was not always used. Shields were not always employed, and when they were, they were frequently positioned incorrectly, in spite of advice. The total prevalence of shield utilization in paediatric imaging was less common than anticipated, suggesting a discrepancy between clinical application and suggested practice. The study shows that gonadal shielding can significantly protect juvenile patients' reproductive organs from radiation when used correctly. On the other hand, shields were frequently positioned incorrectly, which diminished their efficacy. Shields that are not positioned correctly can result in insufficient protection and hide important anatomical areas, requiring repeated exposures and thereby increasing the overall radiation dose. Pediatric patients are more likely to move during imaging, making it challenging to accurately position gonadal shields. This contributes to the higher rate of shield misplacement.

In order to achieve proper shielding and high-quality images when taking X-rays of youngsters, the study highlights the importance of paying close attention to technique and location. The authors advise radiographers to receive further training on gonadal shield placement and usage, especially for pediatric imaging. Additionally, they recommend the creation of uniform policies and procedures to enhance shield application uniformity and reduce kids' exposure to radiation. The study comes to the conclusion that although gonadal shielding can successfully lower radiation exposure in pediatric pelvic X-rays, its potential advantages are undermined by its irregular application and frequent misplacing. To ensure that shielding is applied appropriately and consistently and to maximize its protective effect in pediatric radiography, better training and established practices are required.

Teferi S, Tequabo Y, and Bedane D (2017), the use of gonadal shielding in pelvic radiography and its efficacy. This study, which is exploratory in nature, attempts to evaluate the frequency, precision, and general compliance with radiation safety guidelines in healthcare

environments. The study shows that gonadal shielding is not used during pelvic radiography consistently or on a regular basis. A large number of radiography exams resulted in inadequate protection because the shields were either improperly positioned or completely ignored. This discrepancy in shielding practices was observed in several institutions, with notable variances. A significant portion of the radiographs that were examined revealed gonadal shield misplacement, which either prevented the reproductive organs from being sufficiently protected or hid important anatomical regions, requiring repeat shots. According to the report, misplacing shields is a frequent problem, mostly because radiographers aren't well trained or have clear rules. The study highlights several challenges in the routine use of gonadal shields, including time constraints, difficulty in positioning the shields correctly, and interference with image quality.
Radiographers often prioritized imaging quality over shielding accuracy, contributing to the inconsistent application of protection measures. The authors advocate for better training initiatives to guarantee proper placement throughout procedures and to increase radiographers' comprehension of the significance of gonadal shielding. They also urge the creation of precise, uniform rules for the application of shielding in pelvic radiography as well as more stringent enforcement of radiation safety measures. According to this preliminary investigation, there are a lot of holes in the gonadal shielding protocol used during pelvic radiography. Shields are frequently missed or used incorrectly. The study emphasizes the necessity of tighter compliance with radiation protection guidelines and improved education in order to guarantee patient safety, especially with regard to shielding techniques.

Briggs-Kamara M.A., Okoye P.C., and Omubo-Pepple V.B. (2013) evaluates the knowledge of radiation safety among radiographers and patients in Port Harcourt, Nigeria. The goal of the study is to identify areas of incomplete information and recommend changes to radiation safety procedures. According to the study, radiographers are generally more knowledgeable about radiation safety concepts than patients are. The majority of radiologists were conversant with radiation safety procedures and guidelines, while patients showed little awareness of the dangers of medical radiation. The results show that a large number of patients do not have enough knowledge about the safety precautions that are in place during radiographyoperations. Concerns concerning patients' capacity to make educated decisions about their healthcare are raised by this knowledge gap. The study emphasizes how crucial it is for

radiographers to continue receiving training in order to stay current on the newest procedures and innovations in radiation safety. Additionally, It also calls for the implementation of standardized guidelines to enhance safety measures in clinical settings. The authors suggest improving patient education initiatives to increase knowledge of radiation safety, including the advantages and disadvantages of radiography treatments. They recommend that hospitals take steps to properly educate patients about radiation safety procedures and their exposure to radiation. The study emphasizes the shared responsibility for maintaining safety during radiological examinations and calls for stricter institutional rules that mandate radiation safety training for radiographers and patients alike. The study reveals a notable discrepancy in the level of awareness regarding radiation safety between Port Harcourt patients and radiologists. It highlights how better institutional policies and educational initiatives are required to raise radiation safety awareness and practices in healthcare settings.

Fatahi-Asl J, Tahmasebi M, and Karami V (2013) examines how well-versed radiographers in Ahvaz County, Iran are in radiation protection measures and how they really use them. The purpose of the study is to assess radiographers' knowledge of and proficiency with radiation safety procedures in clinical settings. Although radiographers often possess a basic awareness of radiation protection principles, the study reveals significant gaps in their knowledge regarding current recommendations and optimal procedures. Radiographers differ in their awareness according to their training and experience. Even with understanding, radiation safety precautions were not consistently used in practice. During imaging treatments, many radiographers did not carefully follow safety regulations. The successful use of radiation protective procedures has been shown to be hampered by a number of factors, including a lack of institutional support, resources, and training. The results imply that training and teaching initiatives that are ongoing are essential to improving radiographers' proficiency and understanding. Adherence to protocols could be enhanced by regular training and updates on the most recent radiation safety measures. The authors suggest standardizing rules and conducting frequent evaluations of radiographers' radiation protective procedures and understanding. To promote a culture of safety in radiography departments, it is also important to increase institutional support for radiation safety programs. The study reveals notable deficiencies in Ahvaz County radiographers' performance and understanding of radiation protection. It emphasizes how crucial it is to have institutional support and continual education to enhance safety procedures, which will ultimately guarantee better

protection for both patients and healthcare professionals.

Zabihzadeh M (2016) examines the frequency of gonadal shielding application and the precision of its positioning during pelvic X-ray exams. The purpose of this study is to evaluate shielding's efficacy in reducing radiation exposure to reproductive organs as well as adherence to radiation protection guidelines. The study concludes that during pelvic radiography, gonadal shielding is not always used. Despite recommendations for their use, particularly in populations such as paediatric and reproductive-age patients, a considerable proportion of patients were not provided with shields. When shielding was employed, placement precision was frequently off. Numerous shields were positioned incorrectly or misaligned, which could have compromised imaging quality and left the gonads under protected. The study emphasizes how incorrect placement may require repeat imaging, which would eventually increase radiation exposure instead than lowering it.

The results highlight the necessity of improved training and protocol compliance among radiologists in order to guarantee the proper and efficient use of gonadal shields. The study highlights that in order to optimize shields' protective effects and reduce needless radiation exposure, appropriate shield placement is essential. In order to strengthen radiographers' abilities in shield placement and to emphasize the significance of radiation protection protocols, the author suggests that they attend frequent training sessions. To maintain uniformity and efficacy, it is advised that defined rules for gonad shielding in pelvic radiography be put into practice.
This study reveals serious inadequacies in the gonadal shield placement frequency and accuracy during pelvic radiography. It asks for improved training and standardization of techniques by recognizing these problems in order to improve radiation safety for patients having these operations.

Wainwright A (2000) investigates gonadal shielding's significance and efficacy in orthopedic patients getting pelvic X-rays. The need to safeguard reproductive organs from radiation exposure while maintaining diagnostic quality is the main focus of the research. The study highlights the importance of gonadal shielding in reducing radiation exposure to reproductive organs, especially in individuals with orthopaedic conditions who would eventuallyneed several radiographic exams. Wainwright draws attention to the potentially harmful long- term effects of radiation exposure as well as the reproductive tissues' heightened susceptibility toit. The author

evaluates how gonadal shielding is currently applied in clinical settings and finds instances where suggested criteria are not being followed. The study discovers that, despite shielding's established advantages, its use is not always followed, especially when imaging is necessary and radiation safety concerns may take a back seat. Wainwright talks on the issues radiographers' encounter, such as the practical difficulties of placing shields correctly without sacrificing image quality. The report also mentions the possibility that inconsistent shielding utilization is caused by workflow pressures and time restrictions. The author pushes for greater education and understanding of the value of gonadal shielding among medical practitioners. It is imperative to design and execute standardized techniques and practices to guarantee that shielding is applied consistently and positioned appropriately during pelvic radiography. This study emphasizes the significance of gonadal shielding for orthopaedic patients during pelvic radiography, emphasizing the advantages and difficulties associated with its use. It demands better instruction.

Marsh R.M. and Silosky M. (2019), Analyzes the long-standing use of gonadal shielding in diagnostic imaging critically. The writers talk about how attitudes on patient shielding are changing and how it affects radiology practice today. The authors contend that advances in imaging technology have greatly lowered radiation exposures during diagnostic procedures, suggesting that the traditional use of gonadal shielding may no longer be necessary. They draw attention to data indicating that radiation exposure from contemporary imaging methods is negligible and frequently below the level requiring protective gear. According to Marsh and Silo sky, incorrect shield placement can block important anatomical regions, which could reduce diagnostic precision and necessitate repeated imaging. Patients may unintentionally be exposed to more radiation overall as a result of this. The article makes reference to recent revisions to standards issued by reputable organizations, recommending a change to routinely stop gonadal shielding in certain situations, especially when it could reduce the quality of diagnostic images. The authors push radiologists and technicians to concentrate on tailored risk assessment based on

patient age, sex, and clinical context, and they call for a shift away from antiquated methods like routine gonadal shielding. They stress how crucial it is to inform patients about radiation hazards and the reasons behind stopping shielding procedures. This paper makes a strong case for reconsidering the need for gonadal shielding in diagnostic imaging, highlighting the need to strike a balance between patient safety and diagnostic evaluation accuracy. The authors advocate for a change in practice toward evidence-based strategies that take into account new radiation safety recommendations and developments in imaging technology.

Lee MC, Lloyd J, and Solomito MJ (2017), examines whether gonadal shielding can effectively lower radiation exposure in paediatric patients undergoing pelvic radiography. The authors examine the effects of shielding techniques and their applicability to contemporary imaging. The study finds that in juvenile pelvic radiographs, gonadal shielding provides just a limited level of protection. The scientists discovered that shields' intended benefits—namely, maintaining proper shielding of reproductive organs—are frequently undermined by their positioning and potential misplacement. According to Lee et al., poorly positioned shields can obscure crucial anatomical information required for a precise diagnosis, resulting in poor image quality and possibly necessitating additional testing. Patients may unintentionally receive higher radiation doses as a result of this. The authors raise concerns about the requirement of routine gonadal exams by highlighting imaging technology developments that have dramatically lowered radiation exposures in paediatric radiography. The study recommends that standard gonadal shielding procedures in paediatric imaging be revaluated. It highlights how important it is for technicians and radiologists to weigh the benefits of shielding against any potential risks, like higher exposure from repeat scans and picture disturbance. This study highlights the limited efficacy of routine gonadal shielding for juvenile pelvic radiographs, challenging its continued use in light of recent advances in imaging technology. The authors indicate that shielding should not always be the conventional practice and instead advocate a move towards evidence-based practices that put patient safety and diagnostic accuracy first.

European Commission in 2000 offers thorough instructions on the training and education required to guarantee adequate radiation protection in medical environments. The need for

organized training programs to improve patient and healthcare worker safety during radiological treatments is discussed in this paper. The guidelines stress that all individuals involved in medical radiation exposures must receive the proper education and training. This include medical physicists, radiologists, radiographers, and various medical specialists. In order to keep practitioners abreast of the most recent safety procedures and developments in radiation protection, it emphasizes the necessity of ongoing professional development. The document contains suggestions for creating training programs that cover risk assessment, biological effects of radiation, radiation protection principles, and useful shielding methods. It promotes a multidisciplinary approach to training, guaranteeing that all pertinent medical staff members are well-versed in radiation safety. The guidelines offer tactics for putting into practice successful training.

Initiatives, such as partnerships between healthcare providers and educational institutions. To make sure that the programs satisfy the changing needs of the healthcare environment, it mandates that the efficacy of the training be regularly evaluated. In order to ensure compliance with established standards and norms, the research emphasizes the significance of connecting training activities with national and international rules surrounding radiation protection. Strong training frameworks in medical contexts can be established with the help of the European Commission's Guidelines on Education and Training in Radiation Protection for Medical Exposures. These recommendations seek to improve patient and healthcare worker safety by encouraging thorough education on radiation safety and establishing a safety-conscious culturein the medical imaging industry.

CHAPTER – 5

METHODOLOGY

STUDY DESIGN

A cross sectional study

PLACE OF STUDY

Survey done in various hospitals, medical institutes, Healthcare diagnostic centers with different diversities in Delhi NCR to collect the enough data of radiographers of knowledge, concept and awareness regarding gonadal protection and radiation safety.

SAMPLE SIZE

A sample size of 382 informed Google Forms is chosen for the study and subjected to in depth examination.

The survey was extended to radiographers employed in a range of healthcare facilities, such as imaging centers, clinics, and hospitals. Convenience sampling techniques were used to find respondents, and the survey link was distributed via email, social media, and professional networks. In order to maintain confidentiality and promote open communication, participation was entirely optional, and answers were anonymised.

DATA COLLECTION

The survey was administered electronically using a secure online platform, allowing participants to complete the questionnaire at their convenience. Data collection occurred Over a specified period, with reminders sent periodically to maximize response rates. Quantitative data were analyzed using descriptive statistics, while qualitative responses underwent thematic analysis to identify recurring themes and patterns.

METHOD

The cross-sectional, descriptive statistics [25] study was conducted in several hospitals, medical facilities, and conservatoires in the Delhi NCR. The radiographers employed in the radiology department made up the study population. Every participant gave their whole attention to the activity and honestly filled out the questionnaire. The participants received assurances on the privacy and confidentiality of their data. It is a survey-based study, a google form questionnaire will be send to radiographers to evaluate their performance in applying GS (Gonad Shielding) in pelvic regions will be assessed. A checklist will used to evaluate the GS facilities in these medical facilities.

The questionnaire was created and approved by HOD, Guide, Co-Guide, of radiology Department who served as guides and experts. The purpose of the questionnaire was to assess the radiographers' understanding of the RP concepts and their perspective on GS in traditional radiography. Ten geographic questions and nineteen multiple-choice questions about GS knowledge and the concept of radiographers were among the knowledge assessment questions.

STATISTICAL ANALYSIS

The data was input into an excel spreadsheet and subsequently statistical analysis of the information was performed by software SPSS IBM VERSION 26, Descriptive statistics, independent t-test, Pearson correlation test and analysis of variance

INCLUSION CRITERIA

All the data collection done with the consent of respective radiographers around different diversity from various health care industries, institutions, hospitals in Delhi NCR. Only radiographs used to evaluate thepurpose of the study.

- **Primary Sector**

Hospitals, Diagnostics Centers, Health Care Industry

- **Secondary Sector**

Health Care Institutions, Medical Universities, Medical Colleges

- **Tertiary Sector**

Community Health Center urban & Rural, Sub health Center (Urban & Rural)

EXCLUSION CRITERIA

- No survey taken from non-radiological affiliations, retired radiographers who are not currently in practice.
- Non-willing participants

DURATION OF PROJECT

January 2024 to June 2024

ETHICAL APPROVAL

Ethical approval was obtained from the Ethical Committee of Santosh Deemed to be University, Ghaziabad.

CHAPTER – 6

RESULTS

This section presents a thorough examination of the answers from 382 participants concerning their gonadal shielding in radiography knowledge.

The entire study summary and results are included in the results section, demonstrating the conclusions drawn from the investigation. Based on their knowledge, perception, education, awareness, trainings they attended, workplace policies, etc., all radiographers provided their responses. Other multiple-choice questions about GS knowledge and the notion of radiographers were among the knowledge assessment questions. Demographic information includes the radiographers' personal details, such as their age, gender, and educational history.

Demographic Distribution

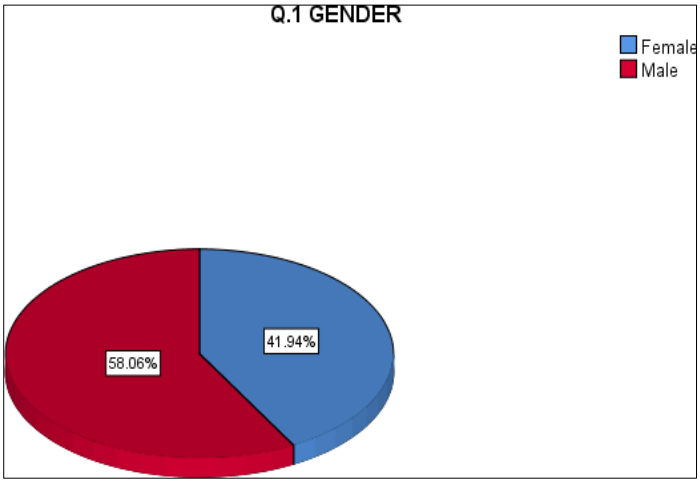
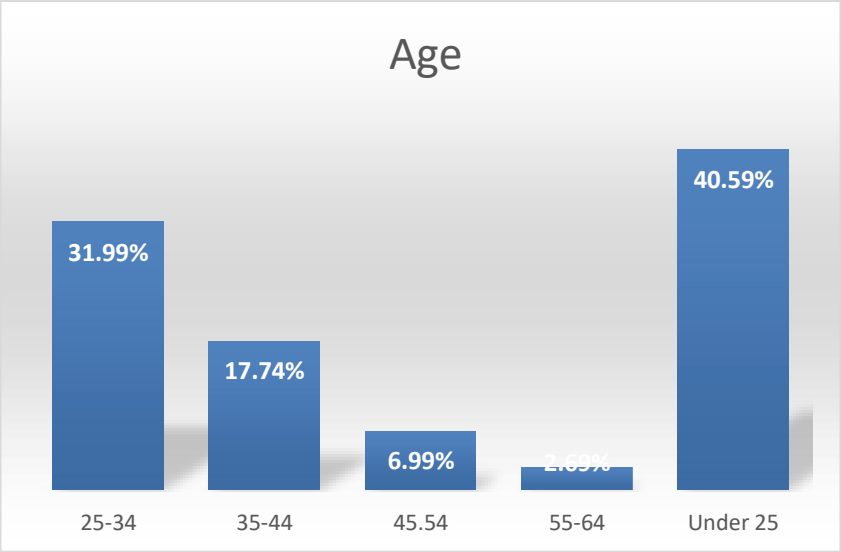


Fig-6: Shows the gender percentage.

There was total 382 respondents in this study. The survey had a slightly representation of males 216 (58.1) compared to females 156 (41.9)

The majority of respondents were male (58.1%), while 41.9% were female (figure-5).



Graph-1: shows the age percentage of radiology staff.

Table-1 shows the responses of social-Demographic and occupational data of radiological staff

Gender					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
	Female	156	41.9	41.9	41.9
	Male	216	58.1	58.1	100.0
	Total	372	100.0	100.0	
Age					
		Frequency	Percent	Valid Percent	Cumulative Percent

	25-34	119	32.0	32.0	32.0
	35-44	66	17.7	17.7	49.7
	45-54	26	7.0	7.0	56.7
	55-64	10	2.7	2.7	59.4
	Under 25	151	40.6	40.6	100.0
	Total	372	100.0	100.0	

What is your highest level of Education?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Associate degree	39	10.5	10.5	10.5
	Bachelor's degree	84	22.6	22.6	33.1
	Doctoral degree	37	9.9	9.9	43.0
	High school or equivalent	103	27.7	27.7	70.7
	Master's degree	98	26.3	26.3	97.0
	Other (please specify)	11	3.0	3.0	100.0
	Total	372	100.0	100.0	

What type of healthcare facility do you primarily work in ?

		Frequency	Percent	Valid Percent	Cumulative Percent
	Clinic	112	30.1	30.1	30.1
	Hospital	138	37.1	37.1	67.2
	Imaging Centre	67	18.0	18.0	85.2
	Other	55	14.8	14.8	100.0
	Total	372	100.0	100.0	

What is your primary role in the healthcare facility?

		Frequency	Percent	Valid Percent	Cumulative Percent
	CT Technologist	66	17.7	17.7	17.7

	General Radiography	156	41.9	41.9	59.7
	MRI Technologist	57	15.3	15.3	75.0
	Nuclear Medicine Technologist	38	10.2	10.2	85.2
	Other	55	14.8	14.8	100.0
	Total	372	100.0	100.0	

According to Table-1 There was total 382 respondents in this study. The survey had a slightly representation of males 216 (58.1) compared to females 156 (41.9)

The majority of respondents were male (58.1%), while 41.9% were female (figure-5).The age group breakdown showed that the highest number of respondents were under 25 years old (40.6%), followed by 25-34 years (32%), 35-44 years (17.7%), 45-54 years (7%), and 55-64 years (2.7%) (Graph-1).

Educational Background

In terms of educational attainment, 27.7% of the respondents held a high school diploma or equivalent, followed by 26.3% with a master's degree. Additionally, 22.6% had a bachelor's degree, 10.5% held an associate degree, and 9.9% had a doctoral degree.

Workplace Environment

The majority of participants worked in hospitals (37.1%), followed by clinics (30.1%), imaging centers (18%), and other healthcare facilities (14.8%) . Regarding their roles, 41.9% worked in general radiography, 17.7% as CT technologists, 15.3% as MRI technologists, and 10.2% in nuclear medicine.

Graph-2 shows the graphical distribution of Responses of the knowledge of Radiologicalstaff about Gonadal shielding.

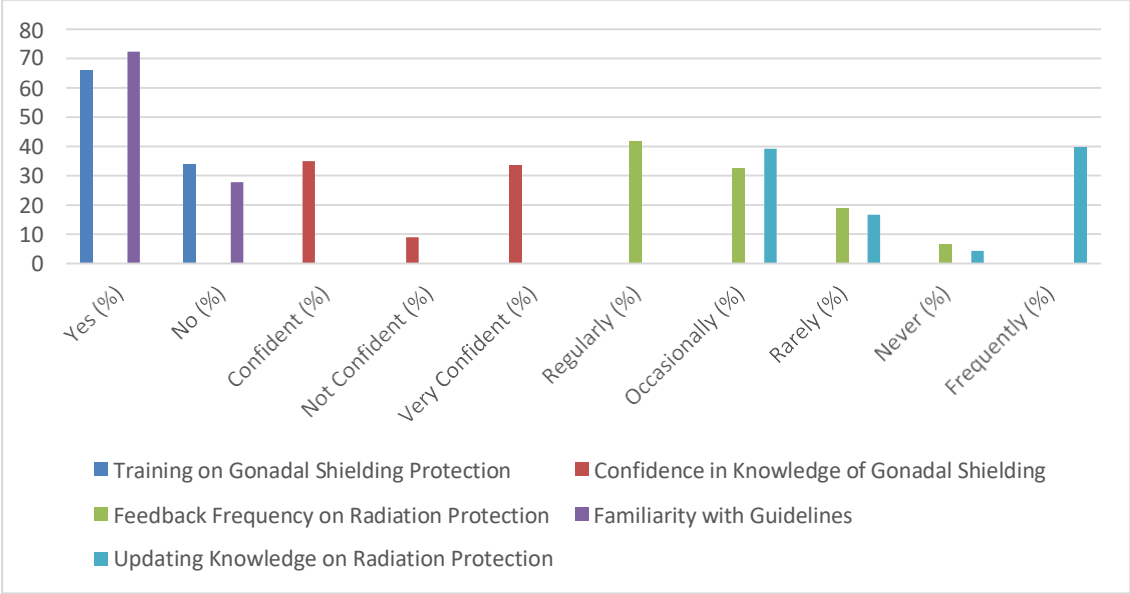


Table-2 shows the Frequency distribution of Responses of the knowledge of Radiologicalstaff about Gonadal shielding.

Have you received specific training on Gonadal Shielding Protection?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	No	126	33.9	33.9	33.9
	Yes	246	66.1	66.1	100.0
	Total	372	100.0	100.0	
How confident are you in your knowledge of gonadal shielding techniques?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Confident	130	34.9	34.9	34.9
	Neutral	84	22.6	22.6	57.5
	Not confident	33	8.9	8.9	66.4
	Very Confident	125	33.6	33.6	100.0
	Total	372	100.0	100.0	
How frequently do you receive feedback or training on radiation protection practices?					

		Frequency	Percent	Valid Percent	Cumulative Percent
	Never	25	6.7	6.7	6.7
	Occasionaly	122	32.8	32.8	39.5
	Rarely	70	18.8	18.8	58.3
	Regulary	155	41.7	41.7	100.0
	Total	372	100.0	100.0	
Are you familiar with current guidelines or recommendations regarding Gonadal Shielding Protection?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	No	103	27.7	27.7	27.7
	Yes	269	72.3	72.3	100.0
	Total	372	100.0	100.0	
How often do you update your knowledge on Radiation Protection Practices?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Frequently	148	39.8	39.8	39.8
	Never	16	4.3	4.3	44.1
	Occasionally	146	39.2	39.2	83.3
	Rarely	62	16.7	16.7	100.0
	Total	372	100.0	100.0	

According to Table- 2

Gonadal Shielding Training and Knowledge

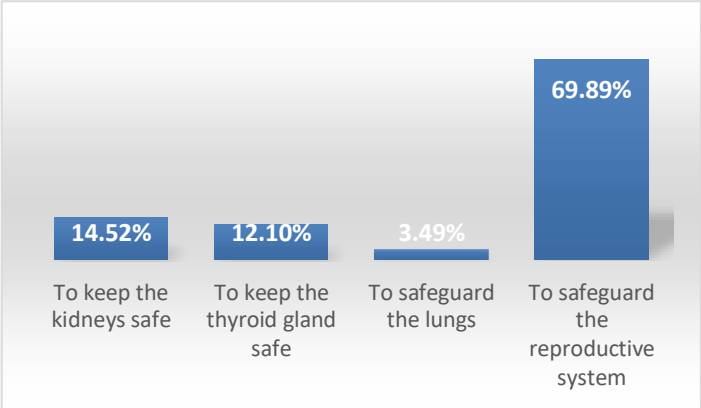
66.1% of respondents reported receiving specific training on gonadal shielding, while 33.9% had not (Graph-2). When asked about their confidence in gonadal shielding techniques, 34.9% were confident, and 33.6% were very confident. However, 8.9% were not confident, and 22.6% were neutral in their confidence level .

Frequency of Feedback and Familiarity with Guidelines

When it came to receiving feedback or training on radiation protection, 41.7% received it regularly, while 32.8% received it occasionally, and 6.7% never received any feedback (figure.8). Regarding familiarity with current guidelines on gonadal shielding, 72.3% of respondents were familiar with the recommendations, while 27.7% were not.

Knowledge Updates on Radiation Protection

Regarding the frequency of updating their knowledge on radiation protection, 39.8% did so frequently, while 39.2% did so occasionally. 16.7% updated their knowledge rarely, and 4.3% never updated it.



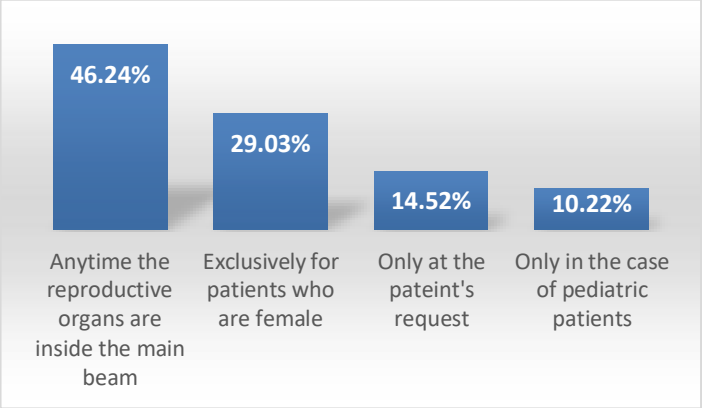
Graph-3: Shows the main goal of gonadal shielding.

In Radiography, What is the main goal of gonadal shielding ?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	To keep the kidneys safe	54	14.5	14.5	14.5
	To keep the thyroid gland safe	45	12.1	12.1	26.6
	To safeguard the lungs	13	3.5	3.5	30.1
	To safeguard the reproductive system	260	69.9	69.9	100.0
	Total	372	100.0	100.0	

Table-3 Shows the frequency of main goal of gonadal shielding.

Purpose and Appropriateness of Gonadal Shielding

The main goal of gonadal shielding, according to 69.9% of respondents, was to safeguard the reproductive system, with smaller percentages mentioning protection of the kidneys (14.5%), thyroid gland (12.1%), or lungs (3.5%).



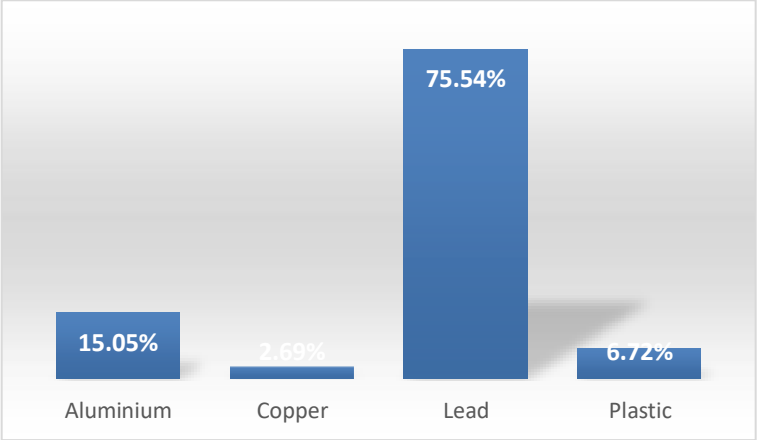
Graph-4: Shows the appropriate utilisation of gonadal shielding during radiographic procedures.

When is it appropriate to utilize gonadal shielding when doing radiography procedures ?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Anytime the reproductive organs are inside the main beam	172	46.2	46.2	46.2
	Exclusively for patients who are female	108	29.0	29.0	75.3
	Only at the pateint's request	54	14.5	14.5	89.8
	Only in the case of pediatric patients	38	10.2	10.2	100.0
	Total	372	100.0	100.0	

Table-4 Shows the frequency of appropriate utilisation of gonadal shielding during radiographic procedures.

In terms of appropriate use, 46.2% agreed that gonadal shielding should be used whenever

reproductive organs are in the main beam, while 29% said it should only be used for female patients.



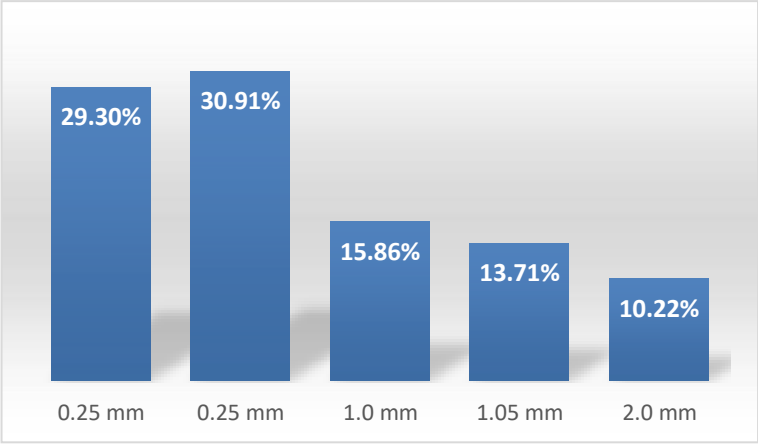
Graph-5: Shows the kind of material used in gonadal shielding.

Table-5 Shows the frequency of kind of material used in gonadal shielding.

What kind of material is suggested for gonadal shielding?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Aluminium	56	15.1	15.1	15.1
	Copper	10	2.7	2.7	17.7
	Lead	281	75.5	75.5	93.3
	Plastic	25	6.7	6.7	100.0
	Total	372	100.0	100.0	

Shielding Materials and Thickness

The preferred material for gonadal shielding was overwhelmingly lead (75.5%), followed by aluminum (15.1%) and plastic (6.7%) . (GRAPH-5)

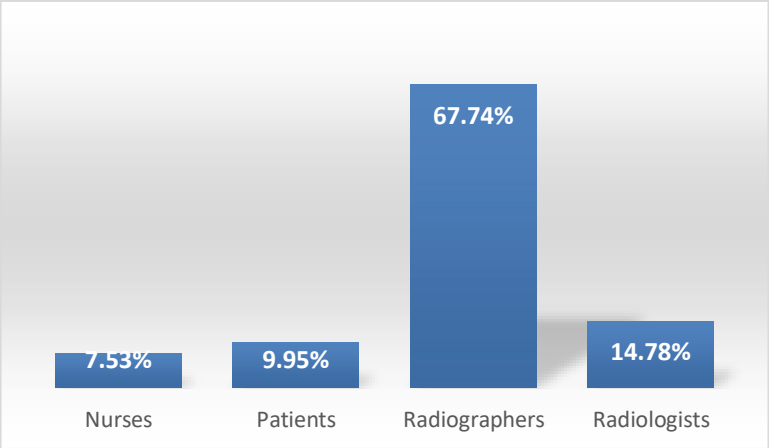


Graph-6: Shows the radiographers knowledge on average value of gonadal thickness.

What is the average gonadal shield thickness?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	0.25 mm	109	29.3	29.3	29.3
	0.5 mm	115	30.9	30.9	60.2
	1.0 mm	59	15.9	15.9	76.1
	1.05 mm	51	13.7	13.7	89.8
	2.0 mm	38	10.2	10.2	100.0
	Total	372	100.0	100.0	

Table-6 Shows frequency of the radiographers knowledge on average value of gonadal thickness.

Regarding the thickness of gonadal shields, 30.9% reported using shields with a thickness of 0.5 mm, while 29.3% used 0.25 mm shields(GRAPH-6)



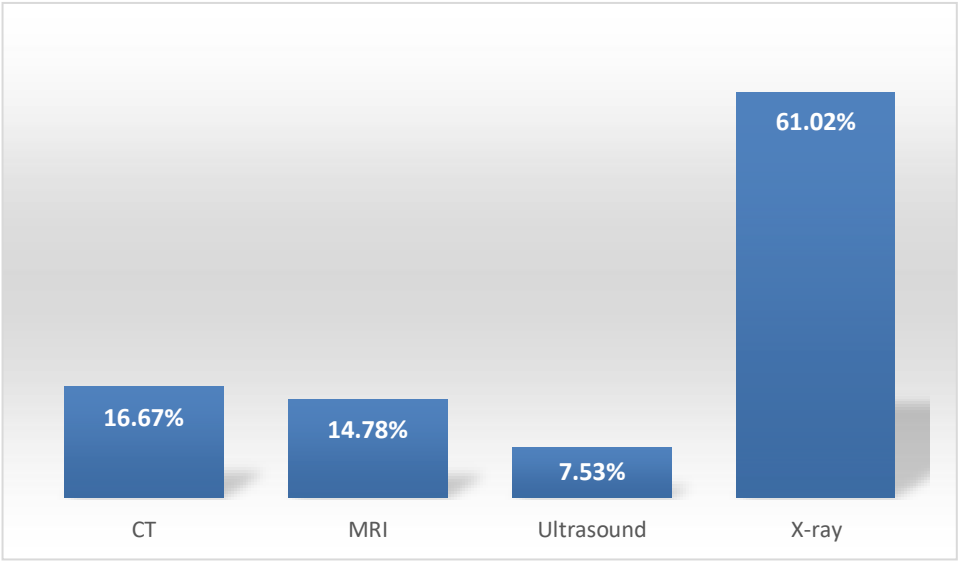
Graph-7: Shows the radiographers knowledge on duty of placing the gonadal shields after the procedure.

Who sets the gonadal shields in place for radiography procedures?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Nurses	28	7.5	7.5	7.5
	Patients	37	9.9	9.9	17.5
	Radiographers	252	67.7	67.7	85.2
	Radiologists	55	14.8	14.8	100.0
	Total	372	100.0	100.0	

Table-7.Shows the radiographer's knowledge on duty of placing the gonadal shields after the procedure.

Setting Shields and Common Applications

67.7% of respondents indicated that radiographers were responsible for setting the gonadal shields in place, while 14.8% said it was the responsibility of radiologists (GRAPH-7)

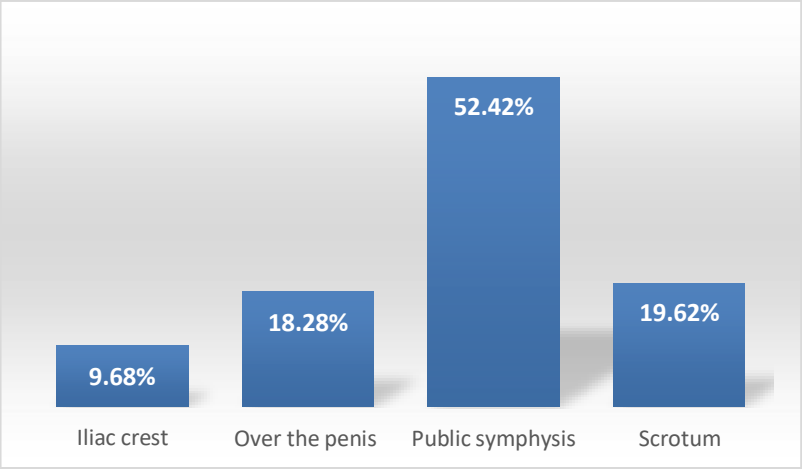


Graph-8: Shows the radiographers conception on kind of imaging in which gonadal shielding frequently applies.

Which kind of imaging is gonadal shielding most frequently applied to?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	CT	62	16.7	16.7	16.7
	MRI	55	14.8	14.8	31.5
	Ultrasound	28	7.5	7.5	39.0
	X-ray	227	61.0	61.0	100.0
	Total	372	100.0	100.0	

Table-8 Shows the frequency of radiographers conception on kind of imaging in which gonadal shielding frequently applies

61% reported using gonadal shielding most frequently in X-ray imaging, followed by CT scans (16.7%) (GRAPH-8).



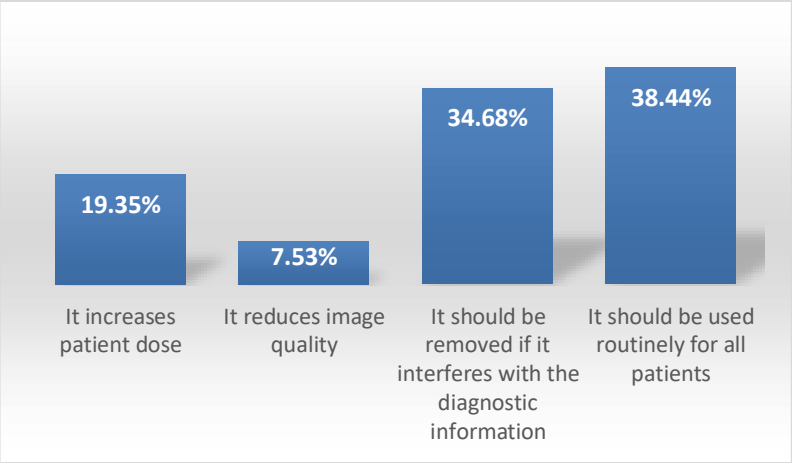
Graph-9: Shows the radiographers knowledge on wearing the gonadal shield.

Where should male patients place their gonadal shields during a pelvic X-ray?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	iliac crest	36	9.7	9.7	9.7
	Over the penis	68	18.3	18.3	28.0
	Pubic symphysis	195	52.4	52.4	80.4
	Scrotum	73	19.6	19.6	100.0
	Total	372	100.0	100.0	

Table -9: Shows frequency the radiographers knowledge on wearing the gonadal shield.

Positioning of Shields for Male Patients

During pelvic X-rays, 52.4% of respondents indicated that male patients should place their gonadal shields over the pubic symphysis, with 18.3% suggesting placement over the penis and 19.6% recommending the scrotum (GRAPH-9).



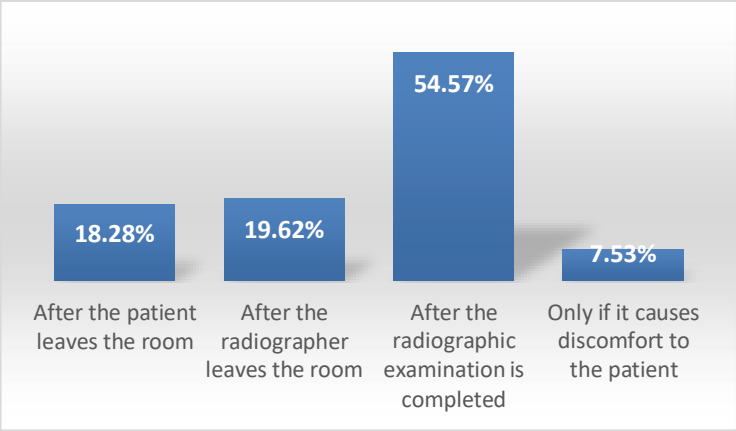
Graph-10: Shows the radiographer knowledge on statements.

Which of the following statements about gonadal shielding is true?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	It increases patient dose	72	19.4	19.4	19.4
	It reduces image quality	28	7.5	7.5	26.9
	It should be removed if it interferes with the diagnostic information	129	34.7	34.7	61.6
	It should be used routinely for all patients	143	38.4	38.4	100.0
	Total	372	100.0	100.0	

Table-10: Shows the frequency of radiographer knowledge on statements.

Effects of Gonadal Shielding and Removal Criteria

When asked about the effects of gonadal shielding, 34.7% agreed that the shield should be removed if it interferes with the diagnostic information, while 38.4% felt that it should be used routinely for all patients (GRAPH-10).

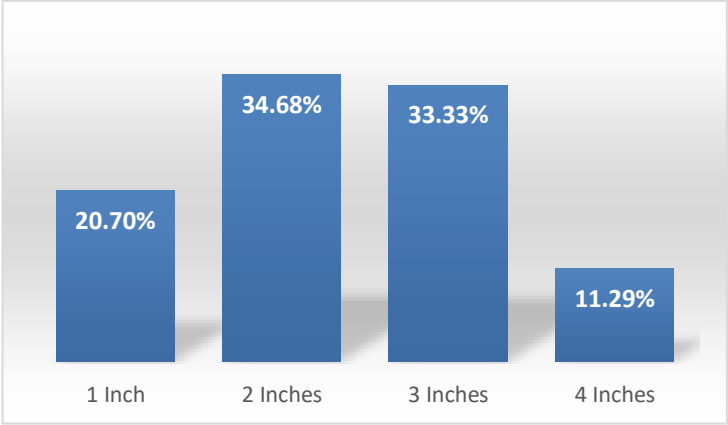


Graph-11: Shows the radiographers knowledge on when to remove gonadal shielding during procedure.

When should gonadal shielding be removed during radiographic procedures?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	After the patient leaves the room	68	18.3	18.3	18.3
	After the radiographer leaves the room	73	19.6	19.6	37.9
	After the radiographic examination is completed	203	54.6	54.6	92.5
	Only if it causes discomfort to the patient	28	7.5	7.5	100.0
	Total	372	100.0	100.0	

Table-11: Shows the radiographers knowledge on when to remove gonadal shielding duringprocedure.

54.6% of respondents believed that gonadal shielding should be removed after the radiographic examination is completed (GRAPH-11).



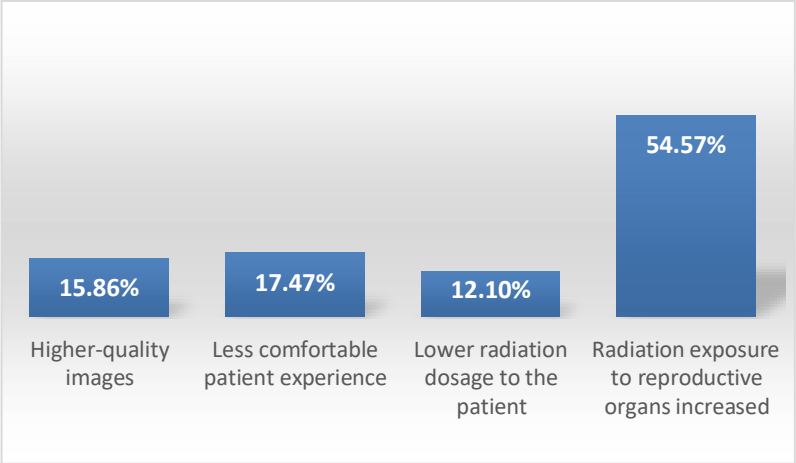
Graph-12: Shows the radiographers knowledge for minimum distance between the gonadal shield and the area being imaged.

What is the recommended minimum distance between the gonadal shield and the area being imaged?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	1 inch	77	20.7	20.7	20.7
	2 inches	129	34.7	34.7	55.4
	3 inches	124	33.3	33.3	88.7
	4 inches	42	11.3	11.3	100.0
	Total	372	100.0	100.0	

Table-12: Shows the frequency of radiographers knowledge for minimum distance between the gonadal shield and the area being imaged.

Distance and Consequences of Not Using Shields

The recommended minimum distance between the gonadal shield and the area being imaged was 2 inches for 34.7% of respondents, with 33.3% recommending a 3-inch distance (GRAPH-12).

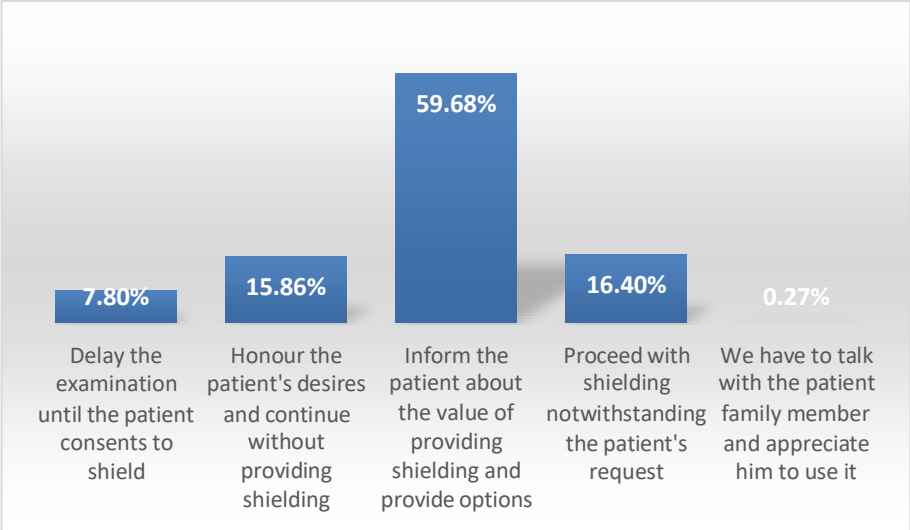


Graph-13: Shows the radiographers point of view on the outcomes when gonadal shield is not used.

If gonadal shielding is not used, what could be the possible outcome?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Higher-quality images	59	15.9	15.9	15.9
	Less comfortable patient experience	65	17.5	17.5	33.3
	Lower radiation dosage to the patient	45	12.1	12.1	45.4
	Radiation exposure to reproductive organs increased	203	54.6	54.6	100.0
	Total	372	100.0	100.0	

Table-13: Shows the frequency of radiographers point of view on the outcomes when gonadal shield is not used

54.6% of participants indicated that increased radiation exposure to reproductive organs was the main consequence of not using shielding, while 15.9% suggested that not using shielding could lead to higher-quality images (GRAPH-13).


59.68%
7.80%
15.86%
16.40%
0.27%
Delay the examination until the patient consents to shield
Honour the patient's desires and continue without providing shielding
Inform the patient about the value of providing shielding and provide options
Proceed with shielding notwithstanding the patient's request
We have to talk with the patient family member and appreciate him to use it

Graph-14: Shows the analysis from radiographers on should radiographers proceed or not if patient declines to utilise the gonadal shielding.

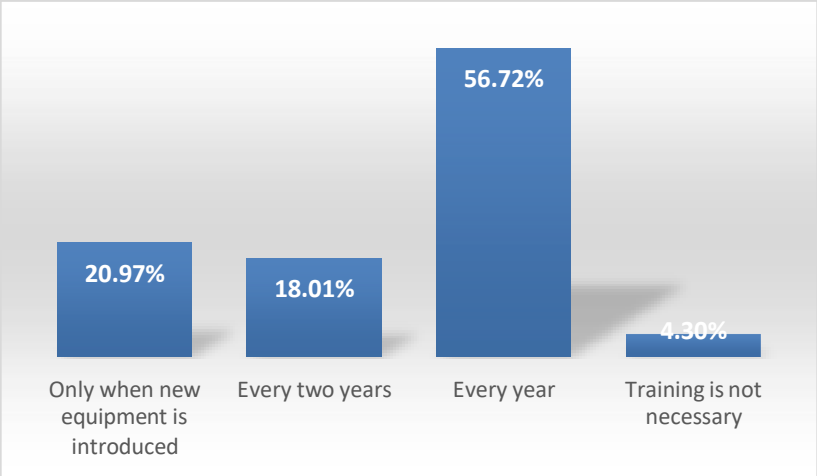
Should radiologists proceed if a patient declines to utilize gonadal shielding?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Delay the examination until the patient consents to shield	29	7.8	7.8	7.8
	Honour the patient's desires and continue without providing shielding	59	15.9	15.9	23.7
	Inform the patient about the value of providing shielding and provide options	222	59.7	59.7	83.3
	Proceed with shielding notwithstanding the patient's request	61	16.4	16.4	99.7
	We have to talk with the patient family member and appreciate him to use it	1	.3	.3	100.0
	Total	372	100.0	100.0	

Table-14: Shows the frequency of the analysis from radiographers on should radiographersproceed or not if patient declines to utilise the gonadal shielding.

Responding to Patient Preferences

When a patient declines the use of gonadal shielding, 59.7% of respondents suggested informing

the patient about the importance of shielding and offering options, while 16.4% recommended proceeding with shielding regardless of the patient's request (GRAPH-14).



Graph 15: Shows the analysis among radiology staff in how much time radiographers should get gonadal shielding training.

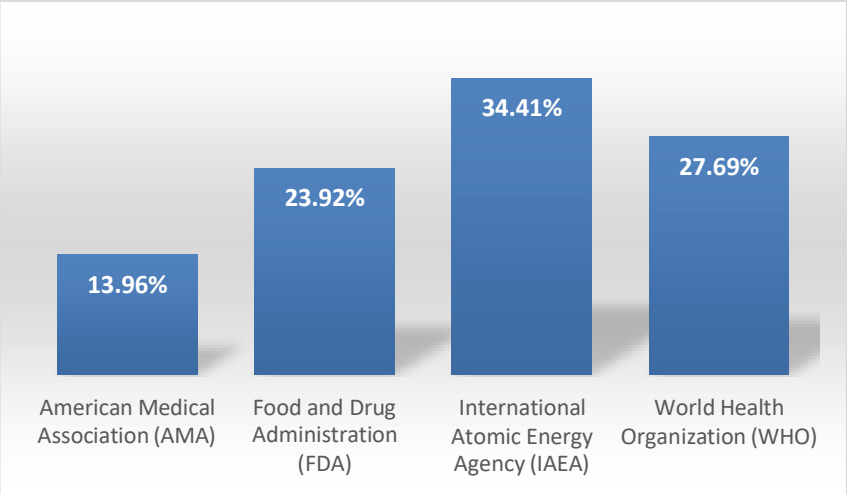
How often should radiographers receive training on gonadal shielding techniques?

		Frequency	Percent	Valid Percent	Cumulative Percent
	C) Only when new equipment is introduced	78	21.0	21.0	21.0
	Every two years	67	18.0	18.0	39.0
	Every year	211	56.7	56.7	95.7
	Training is not necessary	16	4.3	4.3	100.0
	Total	372	100.0	100.0	

Table- 15: Shows the frequency of analysis among radiology staff in how much time radiographers should get gonadal shielding training.

Frequency of Training

56.7% of respondents indicated that radiographers should receive training on gonadal shielding techniques annually, while 21% felt that training should only occur when new equipment is introduced (GRAPH-15).



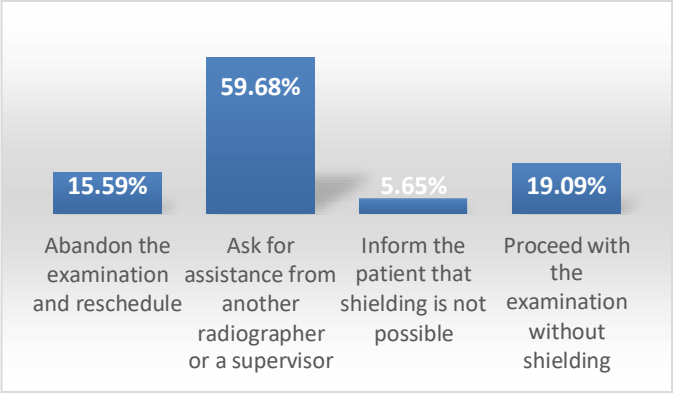
Graph-16: Shows the analysis of radiographers knowledge on regulatory body who provides guidelines of GS.

Which regulatory body provides guidelines on the use of gonadal shielding?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	American Medical Association (AMA)	52	14.0	14.0	14.0
	Food and Drug Administration (FDA)	89	23.9	23.9	37.9
	International Atomic Energy Agency (IAEA)	128	34.4	34.4	72.3
	World Health Organization (WHO)	103	27.7	27.7	100.0
	Total	372	100.0	100.0	

Table-16: Shows the frequency of the analysis of radiographers knowledge on regulatory body whoprovide guidelines of GS.

34.4% of participants identified the International Atomic Energy Agency (IAEA) as the regulatory body responsible for providing guidelines on gonadal shielding

(Graph-16).


59.68%
15.59%
5.65%
19.09%
Abandon the examination and reschedule
Ask for assistance from another radiographer or a supervisor
Inform the patient that shielding is not possible
Proceed with the examination without shielding

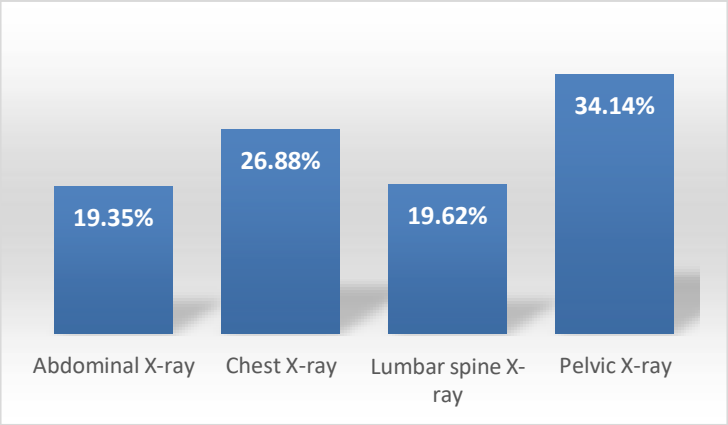
Graph-17: Shows the radiographers prospective to encounter difficulties in positioning gonadal shields.

What should radiographers do if they encounter difficulties in positioning gonadal shields?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Abandon the examination and reschedule	58	15.6	15.6	15.6
	Ask for assistance from another radiographer or a supervisor	222	59.7	59.7	75.3
	Inform the patient that shielding is not possible	21	5.6	5.6	80.9
	Proceed with the examination without shielding	71	19.1	19.1	100.0
	Total	372	100.0	100.0	

Table-17: Shows the radiographers prospective to encounter difficulties in positioning gonadal shields.

Addressing Issues with Shielding Positioning

In situations where radiographers encounter difficulties in positioning gonadal shields, 59.7% recommended asking for assistance from another radiographer or supervisor, while 19.1% said to proceed with the examination without shielding (GRAPH-17).



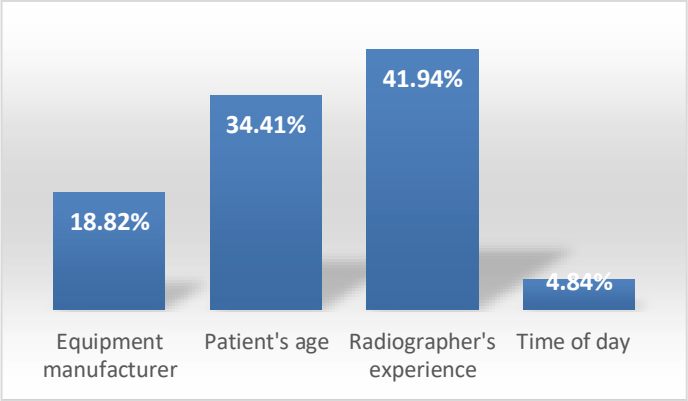
Graph-18: Shows the radiographer knowledge on imaging scenario that typically does not require gonadal shielding.

Which imaging scenario typically does not require gonadal shielding?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Abdominal X-ray	72	19.4	19.4	19.4
	Chest X-ray	100	26.9	26.9	46.2
	Lumbar spine X-ray	73	19.6	19.6	65.9
	Pelvic X-ray	127	34.1	34.1	100.0
	Total	372	100.0	100.0	

Table-18: Shows the frequency of radiographer's knowledge on imaging scenario that typically does not require gonadal shielding.

Situations That Do Not Require Shielding

Respondents were asked about imaging scenarios where gonadal shielding is typically not required. 34.1% indicated that shielding is not necessary during pelvic X-rays, while 26.9% said chest X-rays do not require shielding (GRAPH-18).



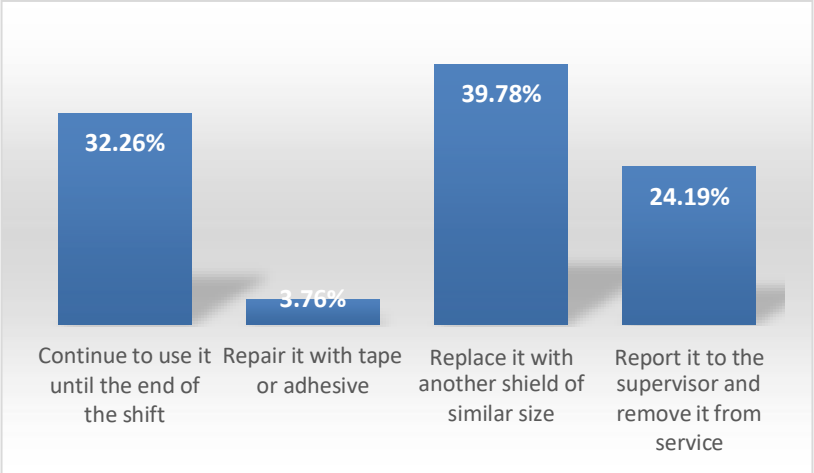
Graph-19: Shows the radiographers knowledge on factors that influences the effectiveness of gonadal shielding.

Which of the following factors influences the effectiveness of gonadal shielding?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Equipment manufacturer	70	18.8	18.8	18.8
	Patient's age	128	34.4	34.4	53.2
	Radiographer's experience	156	41.9	41.9	95.2
	Time of day	18	4.8	4.8	100.0
	Total	372	100.0	100.0	

Table-19: Shows the frequency of radiographers knowledge on factors that influences the effectivenessof gonadal shielding.

Factors Influencing Shielding Effectiveness

The effectiveness of gonadal shielding was said to be influenced primarily by the radiographer's experience (41.9%), followed by the patient's age (34.4%) (GRAPH-19).


32.26%
3.76%
39.78%
24.19%
Continue to use it until the end of the shift
Repair it with tape or adhesive
Replace it with another shield of similar size
Report it to the supervisor and remove it from service

Graph-20: Shows the radiographers conception on appropriate action if a gonadal shield becomes damaged or compromised.

What is the appropriate action if a gonadal shield becomes damaged or compromised?					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Continue to use it until the end of the shift	120	32.3	32.3	32.3
	Repair it with tape or adhesive	14	3.8	3.8	36.0
	Replace it with another shield of similar size	148	39.8	39.8	75.8
	Report it to the supervisor and remove it from service	90	24.2	24.2	100.0
	Total	372	100.0	100.0	

Table-20: Shows the frequency of radiographer's conception on appropriate action if a gonadal shield becomes damaged or compromised.

Handling Damaged Shields

Finally, when dealing with damaged or compromised shields, 39.8% suggested replacing the shield with another one of similar size, while 24.2% recommended reporting the damaged shield to a supervisor and removing it from service (figure.28).

There were total 382 responses of 29 questions among which 1o questions were demographic based and other 19 questions were on the basis of technical information about gonadal shielding protection, its uses, significance of gonadal shield, utilisation of GS, proper wearing position, placement of gonadal shielding after the completion of radiological procedures.

The data analysis done on the basis of percentage of responses from different workplaces, the study indicates that the maximum number of questions have high correct percentage.

DISCUSSION

In the study conducted by Hamzian et al. (2021), the authors evaluated radiographers' knowledge, attitudes, and performance concerning gonadal shielding during diagnostic radiology examinations in Southern Khorasan Province hospitals in Iran. The findings of this study have significant implications for policymaking, training, and practice within radiology departments. Addressing the identified gaps can lead to better protection for patients and improved standards of care in the field of diagnostic radiology.

Jeukens et al. (2020), discuss the role of gonad shielding in pelvic radiography in the context of modern optimized X-ray systems. They argue that advancements in imaging technology, including improved radiation dose management and enhanced image quality, may reduce the necessity for traditional gonad shielding practices. The study highlights that while shielding has been a standard protective measure, the efficacy of current X-ray systems in minimizing radiation exposure to sensitive organs could render such practices less critical. The authors emphasize the importance of evaluating the risks and benefits of discontinuing gonad shielding, suggesting that future protocols should be based on comprehensive assessments of patient safety and the capabilities of new imaging technologies. They advocate for further research to establish evidence-based guidelines that reflect these technological advancements, potentially leading to a paradigm shift in radiographic practices.

The study's findings offer insightful information about the gonadal shielding protection methods and expertise of radiologists in the Delhi, NCR, area of India. 382 radiographers were questioned for the study, and the results showed notable trends in their demographics, educational backgrounds, experiences with training, and opinions regarding gonadal shielding. The majority of participants in the sample (40.6%) were under 25 years old, and the sample was predominately male (58.1%). This indicates that the radiography workforce is comparatively young, which could have an impact on the demand for mentorship and training. A master's degree was held by 26.3% of respondents, while a high school diploma was held by 27.7% of respondents. This variability points to a range of exposure, both theoretical and practical, that could influence how gonadal shielding techniques are understood and used in general.

A notable 66.1% of respondents reported having received specific training on gonadal shielding. This high percentage is encouraging, as it suggests that institutions are making efforts to educate their staff on radiation protection.

Only roughly 34.9% of participants felt comfortable with their understanding of gonadal shielding strategies, despite receiving this instruction. This disparity suggests that there may be a disconnect between instruction and comprehension or practical application, necessitating an evaluation of the program's efficacy. To boost radiographers' confidence, future training programs should include both theoretical and practical applications.Of the participants, a sizable majority (72.3%) were aware of the most recent recommendations for gonadal shielding, and 39.8% had updated their knowledge on radiation safety frequently. This suggests a positive trend towards maintaining current knowledge; however, a substantial portion still updates rarely or never. Continuous education is crucial in the fast-evolving field of radiology, and institutions should promote regular workshops and training sessions to ensure all radiographers remain well-informed.The primary goal of gonadal shielding was correctly identified by 69.9% of respondents as protecting the reproductive system, reflecting a strong understanding of the fundamental purpose of shielding. However, the appropriateness of when to use gonadal shielding varied, with only 46.2% believing it should be used whenever reproductive organs are in the primary beam. This suggests some misunderstanding or lack of consensus on best practices, highlighting the need for clear institutional policies and ongoing education.Regarding shielding materials, the overwhelming preference for lead (75.5%) aligns with industry standards, yet the choice of thickness varied, indicating a need for standardized practices to ensure effective shielding. The majority of respondents correctly indicated that radiographers are responsible for placing the shields, underscoring their role in patient safety during radiographic procedures.The responses to patient preferences for gonadal shielding were telling, with 59.7% indicating they would inform patients about the importance of shielding if a patient declined its use. This reflects a commendable approach to patient-centered care, but also raises ethical considerations about patient autonomy versus professional responsibility in radiation safety.
Training should also cover how to navigate these discussions effectively.The study highlighted challenges in positioning gonadal shields, with 59.7% recommending seeking assistance when difficulties arise. This emphasizes the need for collaborative practices within radiology departments to address technical challenges effectively. Additionally, the responses regarding

imaging scenarios where shielding may not be necessary (34.1% for pelvic X-rays) demonstrate a gap in understanding that could lead to inappropriate shielding practices. Enhanced training focused on imaging-specific guidelines could mitigate these misunderstandings. Finally, 56.7% of participants suggested that training on gonadal shielding should occur annually. Regular training and updates on best practices should be mandatory to ensure that all radiographers maintain high standards of patient care and safety.

Limitations and Future Directions

While this study provides valuable insights into current practices and attitudes regarding gonadal shielding, it is important to acknowledge some limitations. First, the data were self-reported, which may introduce bias. Additionally, the study did not assess actual clinical outcomes or radiation exposure levels, which would provide a more direct measure of the effectiveness of gonadal shielding practices.

CHAPTER – 7

CONCLUSION

The findings suggest that while most radiographers are confident in their knowledge and practices related to gonadal shielding, there are still significant areas for improvement. Targeted training programs, regular feedback, and updates to education curricula may help bridge the gaps in knowledge and practice, ensuring better patient protection and adherence to evolving guidelines. Future research could focus on assessing the actual impact of gonadal shielding on patient outcomes and exploring ways to optimize the balance between protection and image quality in radiography. Although The results of this study indicate a commendable level of knowledge and practice among radiographers regarding gonadal shielding, but there should be improvement through targeted training and ongoing education to ensure the highest standards of patient safety and care in radiographic procedures.

CHAPTER – 8

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CHAPTER – 10

ANNEXURES

LETTER OF ETHICAL CLEARANCE FOR DISSERTATION

FROM REGISTRAR OFFICE

SANTOSH
Deemed to be University
(Established u/s 3 of the UGC Act. 1956)

F. No. SU/R/2024/2425[4] Dated: 07.09.2024

Subject: Grant of Ethical Clearance for **Dissertation Protocol** Topic "**A Survey on Radiographer's Concept Knowledge and Performance towards Gonadal Shielding Protection in Delhi NCR, India**", submitted by **SADHNA RAJAN**, student of M.Sc. Medical Imaging Technology, 2022 Batch.

*****

With reference to the request for grant of Ethical Clearance for the Dissertation Protocol entitled "**A Survey on Radiographer's Concept Knowledge and Performance Towards Gonadal Shielding Protection in Delhi NCR, India", SADHNA RAJAN** is informed that the **Dissertation** Protocol submitted by him/her was considered by the **Screening Committee** of the **Allied Health Sciences** in its meetings held on 07.02.2024 and 29.02.2024. The recommendations of the **Screening** Committee were considered in detail by the **Institutional Ethics Committee** in its meeting held on **15.05.2024** and the same was **approved** by the **Ethics Committee** of the **Santosh Deemed to be University, Ghaziabad, Delhi NCR.**

He /She is informed accordingly for further necessary action.

[Dr. EZHILRAJAN. K]
REGISTRAR

SADHNA RAJAN
M.Sc. Medical Imaging Technology.

Copy to:
1. The Vice Chancellor
2. The Dean — Academics
3. The Dean, SMC&H
4. The Dean — Research
5. The Director — IQAC
6. HOD/ Course In-charge of the concerned Department

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MASTER CHART

Tasks	Tasks Duration	Start Date	End Date	Aug-Sep	Oct-Nov	Dec-Jan	Feb-Mar	Apr-May	Jun-Jul	Aug-Sep
Preparation of thesis proposal	26	10-07-23	05-08-23							
Presentation of thesis proposal	27	05-08-23	28-08-23							
Preparation & Submission Thesis Application in Ethics Committee	43	30-08-23	08-10-23							
Review of Literature	91	10-10-23	05-01-24							
Data Collection	78	17-02-24	26-05-24							
Data Analysis	9	25-06-24	30-06-24							
Finding & Recommendations	11	29-07-24	09-08-24							
Report Writing	28	27-07-24	29-08-24							
Submission of thesis	4	29-08-24	26-09-24							
Presentation of thesis	0									

QUESTIONNAIRE

SECTION- 1 DEMOGRAPHIC INFORMATION

NAME *

GENDER

Male
Female
Other (please specify)

Age

Under 25
25-34
35-44
45-54
55-64
65 or older

What is your highest level of Education ?

High school or equivalent
Associate degree
Bachelor's degree
Master's degree
Doctoral degree
Other (please specify)

What type of healthcare facility do you primarily work in ?

Hospital
Clinic
Imaging Centre
Other (Please specify)

What is your primary role in the healthcare facility?

General Radiography
MRI Technologist
CT Technologist
Nuclear Medicine Technologist
Other (Please specify)

Have you received specific training on Gonadal Shielding Protection ?

Yes
No

How confident are you in your knowledge of gonadal shielding techniques ?

Very Confident
Confident
Neutral
Not confident
Not at all confident

How frequently do you receive feedback or training on radiation protection practices ?

Regulary
Occasionaly
Rarely
Never

Are you familiar with current guidelines or recommendations regarding Gonadal Shielding

Protection ?
Yes
No

How often do you update your knowledge on Radiation Protection Practices ?
Frequently
Occasionally
Rarely
Never

SECTION - 2 **Radiographer's Concept Knowledge & Performance towards GSP (GONADAL SHIELDING PROTECTION)**

Q- 11 In Radiography, What is the main goal of gonadal shielding ?
To keep the kidneys safe
To keep the thyroid gland safe
To safeguard the reproductive system
To safeguard the lungs

Q- 12 When is it appropriate to utilize gonadal shielding when doing radiography procedures ?
Only at the pateint's request
Exclusively for patients who are female
Only in the case of pediatric patients
Anytime the reproductive organs are inside the main beam

What kind of material is suggested for gonadal shielding?
Lead
Aluminium
Plastic
Copper

What is the average gonadal shield thickness?
1.05 mm
0.25 mm
0.5 mm
1.0 mm
2.0 mm

Who sets the gonadal shields in place for radiography procedures?
Radiographers
Nurses
Patients
Radiologists

Which kind of imaging is gonadal shielding most frequently applied to?

MRI
CT
Ultrasound
X-ray

Where should male patients place their gonadal shields during a pelvic X-ray?
Over the penis
Scrotum
Pubic symphysis

iliac crest

Which of the following statements about gonadal shielding is true?
It reduces image quality
It increases patient dose
It should be used routinely for all patients
It should be removed if it interferes with the diagnostic information

When should gonadal shielding be removed during radiographic procedures?
After the patient leaves the room
After the radiographer leaves the room
After the radiographic examination is completed
Only if it causes discomfort to the patient

What is the recommended minimum distance between the gonadal shield and the areabeing imaged?
1 inch
2 inches
3 inches
4 inches

If gonadal shielding is not used, what could be the possible outcome?
Radiation exposure to reproductive organs increased
Higher-quality images
Less comfortable patient experience
Lower radiation dosage to the patient

Should radiologists proceed if a patient declines to utilize gonadal shielding?
Honour the patient's desires and continue without providing shielding
Inform the patient about the value of providing shielding and provide options
Proceed with shielding notwithstanding the patient's request
Delay the examination until the patient consents to shield
Other:

How often should radiographers receive training on gonadal shielding techniques?
Every year
Every two years
C) Only when new equipment is introduced
Training is not necessary
Other:

Which regulatory body provides guidelines on the use of gonadal shielding?
American Medical Association (AMA)
International Atomic Energy Agency (IAEA)
Food and Drug Administration (FDA)
World Health Organization (WHO)
Other:

Q- 25. Which of the following statements about gonadal shielding is false?
It is effective in reducing radiation dose to reproductive organs
It is only necessary for female patients
It should be used during all radiographic procedures involving reproductive organs
It should be selected based on patient size and anatomy

Q- 26 What should radiographers do if they encounter difficulties in positioning gonadal

shields?
Proceed with the examination without shielding
Ask for assistance from another radiographer or a supervisor
Abandon the examination and reschedule
Inform the patient that shielding is not possible

Q- 27 Which imaging scenario typically does not require gonadal shielding?
Chest X-ray
Abdominal X-ray
Lumbar spine X-ray
Pelvic X-ray

Q- 28 Which of the following factors influences the effectiveness of gonadal shielding?
Patient's age
Radiographer's experience
Equipment manufacturer
Time of day

Q- 29 What is the appropriate action if a gonadal shield becomes damaged or compromised?
Continue to use it until the end of the shift
Replace it with another shield of similar size
Report it to the supervisor and remove it from service
Repair it with tape or adhesive